Cement MILL EDITION of

Concrete

Devoted to the Manufacture and Use, of Portland Cement

FEBRUARY, 1935

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Construction Work in National Planning

HIGHWAY systems and large individual engineering projects have long constituted parts of the construction activities of the national government.

◖ Now, in the great scheme of national planning submitted to the new Congress by the President on January 4, the character and scope of government construction work is to be greatly broadened and enlarged, reaching those classes of construction which private enterprise can not undertake.

◖ Clearance of slum areas finds a prominent place among these new undertakings.

◖ Subsistence homesteads and other forms of rural housing, combined with rural electrification, will carry federal construction activities into all sectons of the country.

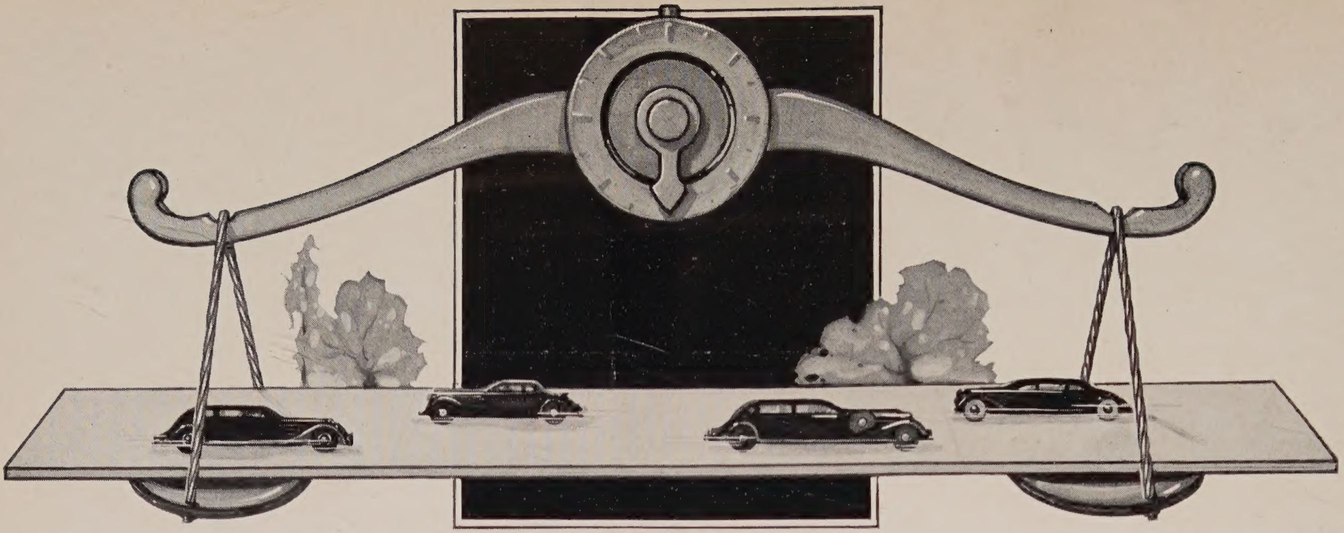
◖ Elimination of grade crossings is only a part of the expanded plan for highway improvement.

◖ Construction of sewerage systems and sewage disposal plants will improve our health and check the growth of stream pollution.

3

◖ Soil and water conservation, combined with reforestation, will require the construction of numerous large and small dams, the relocation of highways and railways, and the moving or reconstruction of buildings and bridges.

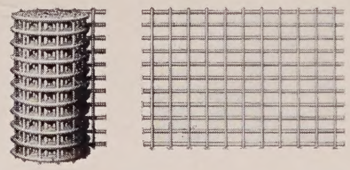
◖ One of the most gratifying things about this enlarged plan is that all the construction work contemplated will add something to our national wealth and security.



POSITIVE CRACK CONTROL

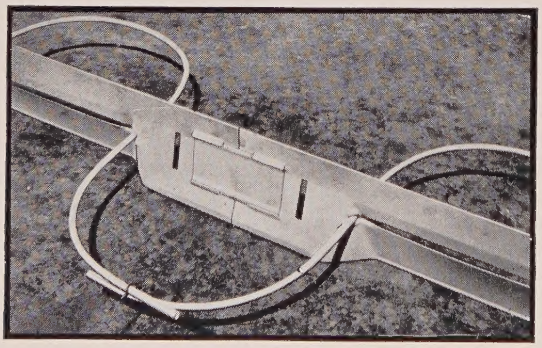
MEANS A BALANCED DESIGN

ELECTRIC WELDED WIRE FABRIC



Furnished in Rolls or Sheets

IN a thickened edge pavement design, test data agree that all cracks that may form and all joints or planes of weakness must be shear resistant in order to provide a balanced design and an adequate Safety Factor. **American Steel & Wire Company Welded Wire Fabric** ties together all unpredetermined cracks that may form in a pavement in spite of **carefully** predetermined expansion and contraction joints. In this manner a balanced design and an adequate Safety Factor is maintained. All cracks as well as joints and planes of weakness remain shear resistant and failure of the concrete is prevented. Our booklet Reinforced Roads and Streets explains in detail the Design procedure for various types of concrete pavements. Your copy will be forwarded on request.



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Vol. XLIII, No. 2 Concrete February, 1935

Concrete Construction Industry in Confident Mood

Regards 1934 as Beginning of Big Things—Both Private and Public Construction Entering Broader Fields—Materials and Methods Improved

THE total volume of contracts awarded for all classes of construction in 1934 amounted to $1,543,000,000, a gain of 23 per cent compared with 1933, according to figures compiled by the F. W. Dodge Corporation for the 37 states east of the Rocky Mountains.

The year recently closed showed a gain over 1933 in eight of the ten general classes of construction, the two exceptions being factories and residential buildings. An increase of more than 50 per cent is reported in contracts for new commercial buildings. Contracts for educational buildings were practically three times the total for 1933, indicating that in this particular class an actual start has been made in the effort to clear up the accumulated shortage. Large increases are also recorded in social and recreational buildings, in public utility structures, and in public works of the engineering type.

Improved Feeling; More Construction

The second half of 1934 saw a moderate volume of construction maintained, but no distinct advance developed; yet the feeling prevails that the new year will see a definite advance in construction volume, not only because of the large new program to be pushed by the federal government, but because of the greatly improved feeling prevailing in business and industrial circles. This thought is emphasized in the Brookmire review of business, construction and prices, dated January 16. Pointing out the improving prospects in industrial areas, this report declares that "business expansion is now definitely under way, and managerial policies should be based on the expectation of further recovery."

The same organization's report of two weeks earlier asserted that "The basis for building revival is gradually being strengthened. The process is a slow one, but it will be stimulated by such developments as rising rents, declining building costs, and halting of deflation in real estate values. The trend of residential rents has been rising for nearly a year. Improving incomes are resulting in increasing demand for space, whereas the supply is virtually unchanged because new construction has barely offset fire losses."

The Beginning of Bigger Things

Regardless of the moderate volume of construction experienced in 1934, much was accomplished toward the beginning of bigger things. Mention has been made of the large increase in contracts for educational buildings as compared with 1933. Likewise, in the matter of renovation and remodeling of old buildings, a forceful stimulant was provided in the Federal Housing Act. Readers of Concrete know that this movement toward remodeling has not been confined to dwelling houses, but has extended to industrial and commercial buildings. A safe prediction is that the years just ahead of us will see a large volume of this type of construction, for the reason that commercial and industrial concerns will be inclined to enlarge their floor space by means of additions and upward extensions of existing buildings, rather than by building new structures. This trend is highly desirable from the standpoint of the construction industry, for it involves the modernization and renovation of existing structures, accompanied by only a moderate increase in floor space, instead of the construction of complete new buildings and the vacating of older ones.

The Great Public Works Field

Further promising situations are seen in the fields of slum clearance and subsistence homestead construction. These have passed the experimental stages, and will doubtless find a large place in the new $4,000,000,000 program proposed in the President's message to Congress and expected to be adopted during the present session.

Sewage disposal projects, and municipal power plants and waterworks constitute other classes of construction in which much work has already been done, though it is only a drop in the bucket compared with what remains to be done before we can regard ourselves as a fully civilized nation.

Soil and Water Conservation

Still another undeveloped field of construction—a comparative newcomer—is found in soil and water conservation, as the reader will learn from an ably written series of two articles by A. F. Unckrich beginning in this issue of Concrete. In spite of the general character of this type of work, an enormous amount of concrete will be involved.

In the technological branch of concrete construction—the control of the quality of concrete and the materials used in its making—readers of Concrete during the past year have had the advantage of excellent contributions from concrete technicians, including John C. Sprague, E. B. Rayburn, Jr., Joseph A. Kitts, Wm. Mayo Venable, K. M. McKelvey, and Charles W. Barnes, Jr.

Materials and Methods Improved

The past year has seen the advent of the use of an inflated hose or tube in the forming of concrete culverts and, circular hollow spaces of all kinds, including hollow concrete piling. Several new "mortar projectors," designed for the forcible application of cement-and-sand mortar or concrete containing small coarse aggregates, have made their appearance. The powerful direct-action concrete pump, recently imported from Europe and greatly improved in this country, has been used in constantly increasing amount on large construction projects.

Further progress has been made in the use of high-early-strength cement in winter concreting operations; in the use of special concrete form materials such as metal and plywood; in the continued interest in high-frequency vibration; in the development of special cements for specific purposes; and in the continued improvement of the quality of standard portland cement.

Architectural Concrete for Economy

The increased use of concrete for direct architectural expression has received a great impetus from two sources —the need for greater economy than is possible with older architectural materials, and the architectural campaign inaugurated by the Portland Cement Association. Much more of this story is being told in articles in CONCRETE.

The concrete construction industry is very much alive to the opportunities embodied in the great federal construction program now in the making, and in the predicted rise in the volume of private construction. The industry is prepared for whatever the coming years may demand.

Concrete Institute Hosts to Gather for Annual Convention

SINCE 1905, each of the American Concrete Institute's thirty annual conventions has flung some challenge to accepted practice in concrete design and construction. The 31st annual meeting at the Roosevelt Hotel, New York, February 19-21, celebrating the Institute's 30th anniversary, will be no exception.

As may be expected, the subject of vibration comes in for a large share of the convention's program. New and special cements for special purposes; architectural concrete applied to the small structure as well as the large; the proposed revision of the Institute's building regulations; the permeability of mass concrete; a stocktaking of the future of cement and concrete—these are some of the other broad subjects to be given thorough airings. An excellent exhibit will offer an educational lure for the attention of visitors.

The convention offers not only a program of unexcelled scope and interest, but it provides the opportunity for meeting the leaders in the great field of cement and concrete. There is no charge for registration, and nonmembers will be welcome. Inquiries received indicate a large attendance.

Special railway rates will be in effect for the Institute's meeting, so that members and visitors are urged to obtain their certificates at the time of buying their railroad tickets. An outline of the convention program follows:

OUTLINE OF CONVENTION PROGRAM

1st Session—Tuesday, February 19, 2 p. m.

What is the up-shot of all the recent intensive study of cement —the basic material of concrete? What do the new cements mean to the designer and builder with concrete? What still newer cements are we to look for and for what special purposes? Papers by way of answer to these questions will provide the subject matter of most of the first convention session.

2nd Session—Tuesday, February 19, 8 p. m.

Not since the late Thomas A. Edison exhibited concrete house models in Madison Square Garden, when the Institute held its convention there in December, 1910, have there been more significant developments in the application of concrete to permanence, security and beauty in dwelling house construction, than will be reported at this meeting. Fresh from a triumph in the concrete mosaic ceilings of Washington's new Department of Justice building, John J. Earley will tell how the same kind of high-quality, richly decorative concrete has been used for small dwellings. Monolithic walls, precast joist floors and several typical concrete house jobs will also be described and pictured.

3rd Session—Wednesday, February 20, 2 p. m.

There is probably nothing more debatable than a building code in the making. The Institute is making a new one for concrete. Its Committee will report important progress on this assignment. But progress is always impeded by tradition—every departure is contested, hard fought. In addition to the discussion of the proposed new concrete building regulations, there will be commentaries on specific trends in reinforced concrete design and construction—"Rigid frame design—its economic aspects"; "Thin shell reinforced concrete domes"; "Reinforced concrete hinges."

Dinner—Wednesday, February 20, 7 p. m.

The 31st annual informal dinner—good food at a reasonable price per plate; address by President Bates; the presentation of Institute honor medals; an address by Edward J. Mehren—"Concrete's future in the light of its immediate past"—a stocktaking of the field by a keen observer, a discriminating critic, a thoughtful and engaging speaker.

4th Session—Thursday, February 21, 9:30 a. m.

Everywhere the belief grows that vibration is a most important new means of placing concrete—for economy, for improved quality, with results not possible by traditional placing methods. Yet there can be no question that vibration is not a cure-all, that its successful use imposes the necessity to solve problems peculiar to its use. This convention session, with a series of short reports of experience, was conceived to "get some of the 'bugs' out of vibration."

5th Session—Thursday, February 21, 2 p. m.

Variety will characterize the final convention session—an important report on permeability of mass concrete—Many different concrete placing methods combined on one job—Architectural considerations in concrete bridge design—What kind of man for concrete inspector?

Products Industry Lays Groundwork for Broader Markets

Expect Definite Part in President's Huge Building Program—Concrete Bricks, Precast Joists and Burial Vaults Among Winners in 1934—Better Manufacturing Methods

ONE of the outstanding developments in the concrete products industry in 1934 is seen in the additional progress made toward the acceptance of concrete masonry building units in federal government buildings. The real start in this direction was made in 1933, when D. R. Collins, as the emissary of the National Concrete Masonry Association, broke through the departmental shells at Washington, talked with the men who select materials and write specifications for government buildings, and convinced them of the structural merits and low cost of concrete building units.

Gain Place in Government Buildings

Following this missionary work, the year 1934 saw the acceptance of hollow concrete building units for partitions, for furring and for fireproofing units in United States post office buildings. In 1933 as well as in 1934 the Quartermaster Construction Department of the U. S. Army made generous use of concrete masonry units for army warehouses and similar buildings.

While much further work is required in this direction, the products industry has gained much prestige from what has been accomplished. In view of the huge program of federal government work involved in the President's $4,000,000,000 construction plan, the importance of this acceptance of concrete units can hardly be overestimated.

Precast Joists Prove Their Case

Concerning individual products, the precast reinforced concrete floor joist has made a notable advance in 1934. Many products manufacturers who had overlooked this unit have taken up its manufacture during the past year. Installed in conjunction with a cast-in-place reinforced concrete slab, it produces monolithic fireproof floor construction for dwellings and other lightly loaded buildings at a cost only moderately higher than that of combustible construction.

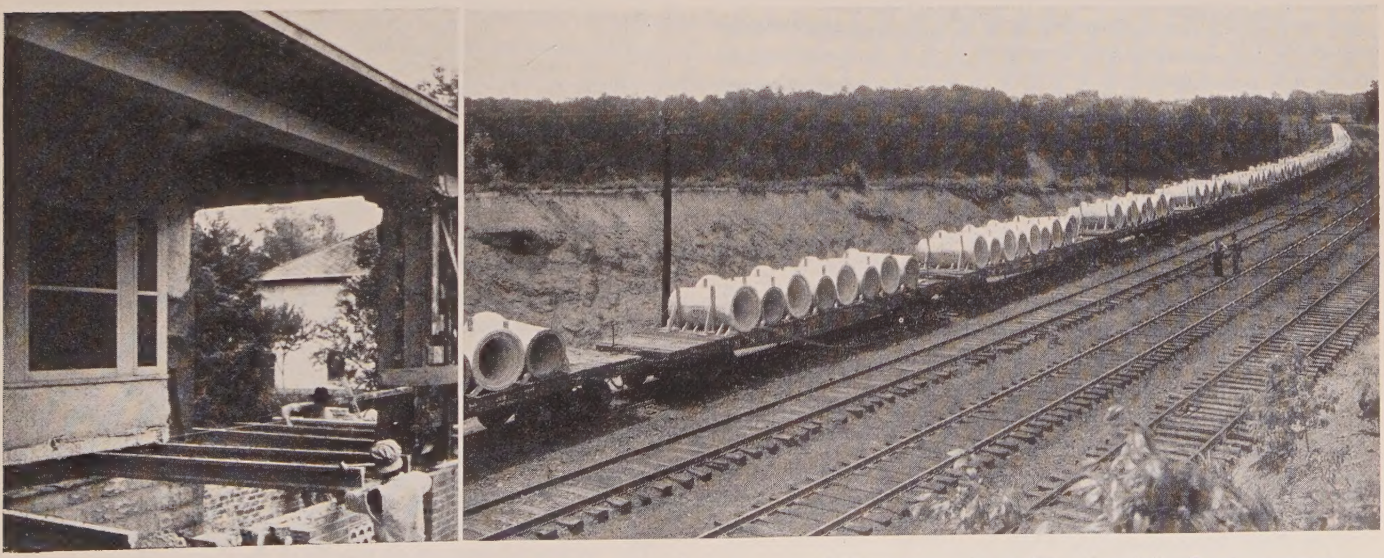
Floors Are Monolithic

Other contributions to our knowledge have convinced architects and structural engineers of the value of this type. Notable among these contributions is the proof that this type constitutes monolithic construction. Tests conducted by F. N. Menefee and reported by him in an article in the March (1934) issue of CONCRETE, proved conclusively that a precast joist and the cast-in-place slab have a perfect bond between them and act structurally as a true T-beam. Similar tests conducted by the Portland Cement Association substantiated in every way the previous conclusions reached by Menefee.

Still further developments affecting the precast reinforced concrete joist and bringing useful information to architects and structural engineers are the design tables (see CONCRETE, July, 1934, page 14) and the construction procedure (see CONCRETE, August 1934, page 17), both supplied by the Portland Cement Association.

Burial Vault Industry Makes Gains

Concrete burial vaults have, likewise, shown outstanding activity in 1934. Several manufacturers of molds for the production of burial vaults have developed new or improved units, and have made notable progress in estab-



At left, precast reinforced concrete floor joists employed on a remodeling job. At right, a trainload of concrete sewer pipe leaving the plant at Montgomery, Ala., for sewer construction at Atlanta, Ga.

lishing the industry on a higher plane. This improvement is seen not only in the quality of the product, but in the more efficient methods of merchandising. An unfortunate trend in the opposite direction is recognized in the fact that too many men with inadequate capital and inadequate experience have entered this field. Producers of this type may do the industry incalculable harm. Large capital investment, merchandising ability and technical knowledge of concrete-making are basic essentials in the production and sale of concrete burial vaults. The man who lacks any of these essentials will be better advised if he leaves it alone.

See Big Markets for Concrete Brick

The various home construction and building remodeling programs to be sponsored by the federal government will undoubtedly prove a stimulant to the concrete products industry, and in this the renewed interest in concrete brick should play an important part.

Concrete brick has, in fact, made a very definite gain within the last twelve months. The development of improved machinery and curing methods for the economical manufacture of bricks of high quality has been responsible for much of this new interest. Concrete brick can meet the price competition of clay brick, even when the latter is manufactured in the same community. In localities which lack suitable clay deposits, concrete brick has a great price advantage. This advantage arises, of course, from the fact that raw materials for concrete are much more widely distributed.

Cast Stone and Ashlar

Concrete units employed in architectural structures, particularly cast stone and concrete ashlar units, will surely reap substantial benefits from the increasing interest in better architecture for the small home. Another development in this direction is the precast ornamental concrete panels for small-house construction, described and illustrated in the December issue of CONCRETE, page 21.

Concrete sewer pipe is another product that has experienced a renewed demand because of the national trend favoring more extensive construction of sewerage systems.

The past year has also seen the development of several new wall units possessing exceptional merit. Products manufacturers are giving more attention to the value of high-frequency vibration, they are making more intelligent use of texture and color, and they appreciate the need for quality above all things. From the production angle, they see the need for a diversity of products, and for the development of new markets in fields thus far untouched.

Concrete Masonry Convention to Discuss Value of National Housing Program

THE wide range of opportunities opened up to the concrete masonry industry by the activities of the Federal Housing Administration and other government-supported construction agencies will be emphasized in the program planned for the annual convention of the National Concrete Masonry Association, to be held at the Pennsylvania Hotel, New York City, on February 18 and 19. This convention will be held just prior to the annual meeting of the American Concrete Institute.

Papers and talks on manufacturing, selling, and marketing, also will be presented, and the NRA code of the industry will be under discussion. Another speaker will tell how 5,000 prospects for concrete houses were developed by an advertising campaign, while an engineer of national prominence will explain the place of concrete units in the fields of heat and sound insulation. The broad scope of subjects may be seen from the program:

Monday Morning, February 18

10:00-11:00—Registration.
11:00-11:30—Report of Directors.
11:30-12:00—Report of Secretary; Committee Appointments.

Monday Afternoon, February 18

2:00-2:30—What the Federal Housing Administration Is Doing to Stimulate Your Market; by Major Charles C. Anthony, Industries Division, FHA, Washington, D. C.
2:30-3:30—Concrete Masonry Houses—The Answer to Long Term Financing; by D. R. Collins, Assistant Secretary, National Concrete Masonry Association, Chicago.
3:30-4:00—Business Session—Election of Directors.
4:00-4:30—An Advertising Campaign That Developed Prospects for 5,000 Concrete Houses; by L. A. Mulhearn, Portland Cement Association, New York.
4:30-5:00—Red House and TVA—Low-Cost Housing Projects of Concrete Masonry; by Einar Christensen, President, National Cinder Concrete Products Association, New York.

Tuesday Morning, February 19

10:00-10:30—How to Make and Sell Concrete Ashlar; by W. J. Decker, Rockland Concrete Products Co., North Bergen, N. J.
10:30-11:00—How Concrete Masonry Manufacturers Can Use High-Early-Strength Cement Economically; by Benjamin Wilk, Standard Building Products Co., Detroit.
11:00-11:30—Why Concrete Masonry Is Increasing in Importance in the Sound and Heat Insulation Field; by W. G. Kaiser, Manager, Cement Products Bureau, Portland Cement Association, Chicago.
11:30-12:00—Why Every Home Builder Is a Prospect for a Concrete Floor; by C. E. Burbank, Bedford Hills Concrete Products Co., Bedford Hills, N. Y.

Tuesday Afternoon, February 19

2:00-2:15—Committee Reports.
2:15-2:45—The Future of NRA; by L. E. Bickelhaupt, Deputy Administrator, NRA, Washington, D. C.
2:45-3:30—Accomplishments of the Concrete Mansory Code and Plans for Future Enforcement; by H. W. Bush, Secretary, Concrete Masonry Code Authority, Teaneck, N. J.
3:30-4:30—Discussion.
4:30-4:45—High Lights of the Convention; by Benjamin Wilk, President, National Concrete Masonry Association, Detroit.
Adjournment to American Concrete Institute (in session at Hotel Roosevelt).

A. S. T. M. Calendar

FOLLOWING is a calendar of the meetings of the A. S. T. M. during 1935:

1935 Regional Meeting—March 6—Philadelphia, Pa.

1935 Group Meetings of A. S. T. M. Committees—March 4 to 8 inclusive—Philadelphia.

Thirty-eighth Annual Meeting—June 24 through 28—Book-Cadillac Hotel, Detroit, Mich.

Exhibit of Testing Apparatus and Related Equipment—concurrent with the annual meeting.

The technical feature of the 1935 Regional Meeting will be a Symposium on Paint sponsored by Committee D-1 on Preservation Coatings for Structural Materials.

Road Builders Hold Annual Meeting and Exhibit in Washington

Four-Day Sessions of Contractors, Public Officials and Manufacturers Deliberate Road Problems and Highway Planning

THE thirty-second annual convention and highway exhibit of the American Road Builders' Association was held at the Willard Hotel, Washington, D. C., January 22-25. A well rounded program of interesting subjects with able speakers brought the largest attendance for several years. The highway exhibits were both smaller in number and size, due primarily to a lack of facilities for exhibition purposes.

The three major planks of the Association's platform were stressed during the deliberations of the Federal, State, County and Municipal officials, road-building contractors and machinery and material men who comprise the organization. They are:

(1) The continuation of an adequate and economic highway and street program.

(2) The use of gasoline taxes and motor license fees (highway revenues) for highway purposes.

(3) The continuation of appropriations by the Federal government for streets and highways.

Highway Planning

Capt. H. C. Whitehurst, Washington, D. C., president of the A.R.B.A., opened the convention with a paper "The Highway Situation." New facts and figures were given on the value and present status of our highway system, especially justifying road building appropriations as the best means of eliminating the nation's unemployment.

Modernization and improvement of the highway system was stressed, if safety requirements are to be met and congestion relieved. In referring to recent published reports, Whitehurst said, "It has been intimated that a new agency may undertake the work of planning a national highway program. While such a program is highly essential to insure economical progress in developing our highway system, why duplicate work already largely accomplished. The several states, in co-operation with the Bureau of Public Roads, have already developed such a plan. . . . There is no agency so completely qualified and with such a wealth of experience as the Bureau of Public Roads to continue this work."

Arthur W. Brandt, president of the American Association of State Highway Officials, read a paper on "An Adequate and Economic Highway Program." Mr. Brandt declared the nation needs "a complete inventory of all existing facilities of highway transportation, including rural roads and city streets, for an articulate plan for the improvement of the entire system to fit it to the greatly altered requirements of the modern vehicle. The survey should include an estimate of both the benefits from the roads and to the existing tax structure." He warned against waste and misapplication of funds.

Thomas H. MacDonald, chief, Bureau of Public Roads, spoke on "Broadening the Highway Program." "Since July, 1933," said Mr. MacDonald, "in the Public Works highway program more than 11,000 individual projects have been placed under way. That 60 per cent of these projects are off the Federal aid highway systems of the states as they existed at the start of the program, roughly measures the velocity attained in broadening the program through liberalizing the Federal highway policies."

Attention was called to the fact that the improvement of roads to date must be regarded as providing only the minimum of service and that "deferred details" such as railroad grade separations, replacement of narrow bridges, and the general construction of footpaths, where justified, were important elements which must be continued in the broadened highway program.

"A Highway Message" was the title of an excellent address given by Hon. Carl Hayden, United States Senator from Arizona, and co-author of the Hayden-Cartwright road bill of the last Congress. Senator Hayden branded the diversion of gasoline taxes to other than highway purposes a serious injustice. He declared that "nothing can compare with the record of highway construction as a quick and effective method of reducing unemployment. Because of this the highway industry has rendered magnificent and efficient service, especially during the last year and a half." He reported that President Roosevelt was entirely sympathetic with the road program.

City Officials' Session

"Federal Participation in the Construction of Major Traffic Arteries of Cities" was the title of a paper presented by Robert R. Brooks, consulting engineer, of St. Louis. "Our Federal Government should participate in the construction of major traffic arteries of cities, not only because it is a duty but because there is an opportunity to spend money wisely at the present time," stated Mr. Brooks. "There are two conditions which must be met by cities today: first, the unemployment problem must be solved, and second, our major traffic arteries must be constructed or reconstructed, or else our growth will be stunted."

Quotations from many city officials were given by Mr. Brooks citing the justification of spending Federal money on city traffic arteries. The state of Virginia was alleged to have paid into the Federal treasury in 1934 a total of $134,000,000, of which the city of Richmond paid $114,000,000, or 85 per cent. The city received in return only 2.2 per cent of the total Federal aid money allotted to the State during the fiscal years 1933-34 and 1934-35.

County Officials' Session

E. L. Gates, president, County Highway Officials' Division, reported on the "Centralized County Unit Road Control of Roads Outside of State Systems." Mr. Gates also read a paper prepared by Allen M. Williams, county engineer, Ionia County, Michigan, in which was described the operation of the Michigan law (passed in 1931) which required that township roads be taken over by the county at the rate of 20 per cent each year. According to Mr. Williams, general public approval and satisfaction have been expressed by the people since the law has been in effect.

"County Highway Work with Relief Funds" was discussed by George C. Wright of Monroe County, New York, and "Secondary Roads and Federal Aid" by Charles Davis, President, National Highways Association.

Technical Session

E. W. James, chief, Division of Highway Transport, Bureau of Public Roads, gave a paper on "Indicated Needs of Railroad Grade Crossing Elimination." In 1933, the last year for which records are available, Mr. James pointed out, there were 1,305 fatalities and approximately three times as many injured, due to accidents at railway grade crossings. The peak for fatalities was reached in 1928, when 2,165 were killed by railroad grade crossing accidents.

Prior to 1930 there was a yearly increase in the total number of highway-railway grade crossings. In 1930 the number of grade crossings were reduced by 136, and the net decrease to date amounts to 1,241. At present there are in the neighborhood of 240,000 grade crossings. Mr. James reported that 70 highway-railway grade separations had been completed, 222 are under contract and 71 have been approved during the past year. Also completed or under contract are 38 highway grade separations.

Road-Building Equipment

An item of much interest on the program was a symposium on latest developments in road-building equipment. "Concrete Paving Equipment" was reported on by E. M. Fleming, Manager of the Highway Bureau, Portland Cement Association.

"A survey of the latest developments in construction equipment," said Mr. Fleming, "indicates that the concrete paving industry is in a better position today than ever before in its existence to turn out a high quality product at a minimum cost."

The paper described the latest improvements in forms, handling and measuring materials equipment, mixers, truck mixers and finishing equipment. In speaking of vibration of concrete pavements it was pointed out that concrete placed by vibration having the same strength as concrete placed by ordinary methods could be made with one less sack of cement per cubic yard. In addition, a vibrated mix of low slump produces concrete that expands and contracts less than unvibrated concrete.

William P. McDonald, president of a large construction company in New York City bearing his name, has been elected president of the American Road Builders' Association, succeeding Captain H. C. Whitehurst, Director of Highways of the District of Columbia.

Concrete Aggregate Associations Invade Chicago in Separate and Joint Conventions

THE National Sand and Gravel Association, the National Crushed Stone Association and the National Slag Association are this year repeating the plan of holding their annual meetings in the same city and at the same time. A year ago this plan was tried out as an experiment at Cincinnati, and the experiment was highly successful. The idea was first suggested as a result of the adoption of a combined NRA code for these three industries, the code having been developed during the latter half of 1933. With so many problems in common, it seemed logical that the three associations should hold their annual meetings at the same time and place; and to help matters along, the National Ready-Mixed Concrete Association has joined the throng now in session—during the week beginning January 28—at the Palmer House, in Chicago.

Programs of Wide Scope

Programs of unusual scope maintained interest at a high level. Unfortunately, due to lack of space, only a summary can here be given. This summary follows:

Monday, January 28—The Code Authority for the three aggregate associations met and organized itself for the year 1935. The same day saw the opening of the machinery and equipment exposition with an "open house" in Exposition Hall, beginning at 5:00 o'clock, at which the manufacturers were hosts. This excellent display of equipment was continued through January 31.

Tuesday, January 29—This day was given over entirely to joint sessions for discussion of the code of the three aggregate associations. With a year of experience to build on, these sessions brought to light many constructive suggestions for the continued self-regulation of the three industries.

Wednesday, January 30—Separate sessions were held during this day by each of the three aggregate associations. Business affairs and technical problems constituted the subjects covered. Papers presented discussed all the principal uses of these materials.

Thursday, January 31—The entire morning was set aside by all the associations to permit delegates to give their undivided attention to the machinery and equipment exposition. During Thursday afternoon the three organizations again were in joint session, listening to talks on the present phase of the recovery program. A joint banquet was held in the evening, following which Dr. John W. Finch, director of the U. S. Bureau of Mines, presented the national safety trophies. An inspiring address was then delivered by W. T. Chevalier, vice-president, McGraw-Hill Publishing Co., principal speaker of the evening.

49th Annual—E. I. of C.

THE forty-ninth annual general meeting of the Engineering Institute of Canada is to be held at the Royal York Hotel, Toronto, on February 7, 8 and 9, 1935.

Friday afternoon, February 8, will be devoted to a discussion of the water supply of the prairie provinces and its bearing on their economic development, and the relationship of geology to soil drifting in southern Manitoba and southern Saskatchewan.

R. J. Durley is general secretary with headquarters at 2050 Mansfield Street, Montreal, Canada.

Place Concrete in Sub-Zero Weather in Erie Railroad Viaduct

Flat-Slab Reinforced Concrete Structure Carries Main-Line Tracks of Railroad in Elmira, N. Y.—Many Interesting Construction Features

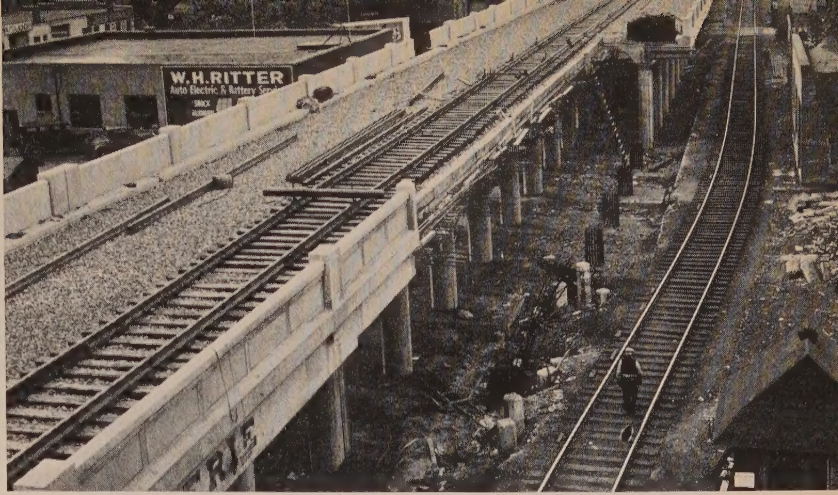


Figure 1. Flat-slab reinforced concrete elevated structure built by E Railroad Co. in Elmira, N. Y., carries two main-line railway tracks, and third track for part of 1,700-ft. length

A VIADUCT of reinforced concrete construction of the flat-slab type, 1,700 ft. long and carrying two main-line tracks of the Erie Railroad and a third track for a part of its length, is the principal structure of a group being built in Elmira, N. Y., in this railway company's grade separation program.

Principal Features of Construction

Aside from the use of the flat-slab type of reinforced concrete for carrying main line railway loading, other important construction features on this project are seen (1) in the use of precast reinforced concrete piles in the viaduct foundations; (2) the driving of these piles three days after casting, a feat that was made possible by the use of high-early-strength cement; (3) the placing of concrete during mid-winter and the protective measures taken; (4) the placing of dry-consistency concrete under the influence of high-frequency vibration; (5) the waterproofing of the deck of the concrete structure and the exposed surfaces of concrete; and (6) the care observed in the form work for the concrete.

The first concrete foundation pile was driven on December 4, 1933. The piles driven on this date had been cast on the site by the general contractor on December 1; and as stated, high-early-strength cement made this possible. Previous tests had shown that piles 18 and 25 ft. in length would be required, and these were employed throughout the length of the viaduct. The piles were designed to support a load of 30 tons each; but the stress due to the impact of the 5,000 lb. steam hammer by which they were driven was considerably in excess of the design stress.

Progressive Construction Procedure

The structure is supported on a series of bents or piers of circular reinforced concrete columns of the type ordinarily employed with flat-slab construction. The nature of the structure naturally led to the adoption of a progressive construction procedure. Following the excavation, piles for the support of a bent were driven. As the pile-driver was moved forward to the next bent, another crew built the form work for the continuous footing over the piles just driven. Next came the crew that concreted the footings, then a crew to erect column forms, then the concreting of the columns, and so on. Before the driving of piles was concluded, part of the structure at the point of beginning was entirely completed.

Use Metal and Plywood Forms

Great care was taken in the construction of the form work, especially for the part of the structure above the footings. The column forms were of heavy-gauge metal, pressed into circular form and held in place by metal yokes. The deck forms were metal pans, supported by shores that rested on the ground. Forms for the parapets and railings were built of wood, but in order to obtain a smooth surface, plywood was used for the sheathing—that is, for immediate contact with the concrete.

Spiral reinforcement for the circular columns was assembled with the vertical rods in the usual way. Reinforcement for the concrete deck and for the parapets and railings was cut and bent into the necessary lengths and shapes, before delivery to the construction site.

Placing and Curing Concrete

The concrete was carefully proportioned in accordance with modern principles, the proportions having been determined from the analyses of the sand and gravel aggregates so as to produce the maximum degree of density. The water-cement ratio selected produced a stiff consistency; but under the influence of the high-frequency vibrators employed, the concrete went into position without trouble, though scarcely any water was brought to the surface. The vibrators used were in part the internal type, while others were attached to the forms. They were driven by compressed air.

Concreting During Sub-Zero Weather

Because of the time this work was started (December, 1933), a large part of the concrete was placed during mid-winter—some of it during sub-zero weather. Aggregates and mixing water were heated, and freshly-placed concrete was covered or inclosed with tarpaulins as soon as possible after it was deposited. The inclosures were heated with salamanders and the temperature was kept at or above 75 deg. F. for one week after concrete was placed. Several times the outside temperature dropped as low as 25 deg. below zero, but no trace of frozen concrete was found anywhere in the structure.

Curing with Live Steam

Live steam was introduced within the inclosures for the double purpose of supplying additional heat and—of greater importance—supplying moisture for the proper curing of the concrete. Without this additional moisture from live steam, the use of salamanders may result in drying the concrete too rapidly, thereby driving out the moisture before the concrete has hardened sufficiently.

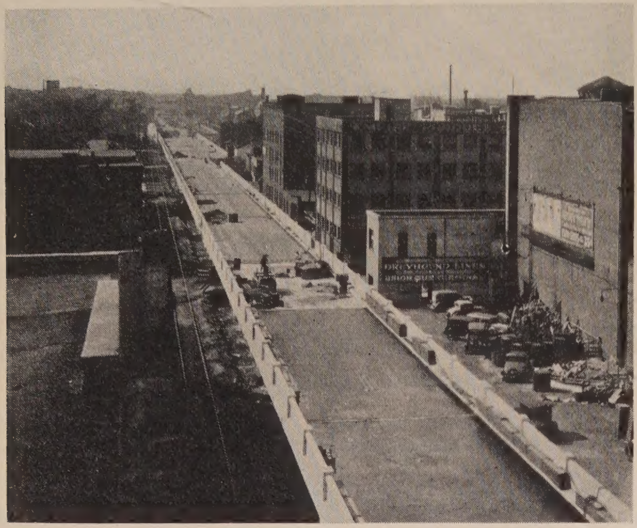


Figure 2. Track-elevation structure at Elmira, N. Y., approaching completion

During the summer of 1934 some extremely hot weather was encountered here, as elsewhere. Concrete placed during this time was kept wet for ten days. Concrete work was practically completed by December, 1934, and the contractor's mixing plant was dismantled in that month.

Waterproofing the Structure

The entire deck of the structure, between parapets, has been filled with track ballast. For this reason it was necessary to protect the surface of the concrete deck from the water accumulated in the ballast. A drainage system was installed to carry off this water; but in addition, the surface of the concrete was waterproofed. First, the entire surface of the deck as well as the vertical faces of the parapets were coated with an asphalt primer. A double thickness of asphalt-saturated cotton fabric was then placed over the coating with moppings of hot asphalt on each layer, after which asphalt planks were placed over the entire area.

All exposed surfaces of the structure were waterproofed with a proprietary liquid, applied after the concrete had been thoroughly cured and its surface was dry.

Acknowledgments: The Folwell Engineering Co., of Chicago, were the general contractors on this interesting structure, which was designed by the engineering department of the Erie Railroad Co., G. S. Fanning, chief engineer. F. A. Howard is engineer of structures, and A. M. Knowles is assistant engineer of structures. C. H. Splitstone is superintendent of construction and Lee W. Walter is inspecting engineer for the railway company. CONCRETE is indebted to Mr. Walter, and to the Elmira *Gazette*, for much of the information on which this article is based.

Cinder Products Association Has Big Program for Annual Convention

THE National Cinder Concrete Products Association will present an excellent program at its eleventh annual convention, to be held at the Hotel Astor, New York City, on February 14, 15 and 16. These dates fall in the week just preceding the annual meetings of the American Concrete Institute and the Concrete Masonry Association.

This yearly meeting, like the ten annual conventions preceding it, is sponsored by the old and responsible cinder unit plants that have continued to function as a united group in good and bad years, with patents and without them.

This year the scope of the convention has been extended to include all makers of concrete masonry, since it is realized that recent research and accumulated experience are of significance to the entire industry, and that all makers of concrete masonry have problems in common. The scheduled program follows:

Thursday, February 14

10:00 A. M.—Registration and Welcome Address—Presenting a New Program for the Industry.
12:30 P. M.—Group luncheon, with prominent speaker on the main subject of the day.
2:00 P. M.—The Federal Housing Program and the Industry. The Industry's Competition in the Small House Field.
7:00 P. M.—Banquet and Entertainment.

Friday, February 15

10:00 A. M.—Bringing the Industry Up to Date.
Sales Ideas:
  Acoustical Design
  Heat Insulation
  General Performance
  Economies—Old and New
Manufacturing Ideas:
  Concrete Joists
  Experience with New Equipment
  Manufacturing at a Profit
12:30 P. M.—Group Luncheon, with the Concrete Masonry Code Administrator addressing the members.
2:00 P. M.—The NRA Code and the Industry. Concrete Masonry of the Future.

Saturday, February 16

10:30 A. M.—1935: A New Deal for the Industry.
A Specification for Aggregate.
An Architect's Specification for the Unit.

Chicago's Home Exposition to Cover Wide Scope

THE Modern Home Exposition—a great general exposition for Chicago's industries, will open on Saturday, February 16, at the Coliseum.

Every line of industry and allied trades influencing home life will be there. The American home complete, including all products that interest the people living in them, will be represented. This will be Chicago's greatest exposition of 1935. It is not a permanent or long-run exposition—nine days and nights, and it's over. But in those nine days, thousands will become "home-minded."

Great Volume of Concrete Work in Conservation Program

Involves Construction of Concrete and Earth-Fill Dams, Check Dams, Spillways, Revetments; Relocation of Highways, Bridges and Buildings; Waterworks and Sewage Disposal Plants

By A. F. UNCKRICH
Conservation Engineer, Columbus, Ohio

WATER conservation is defined as the controlling of the run-off from rainfall and conserving it for future beneficial use. It will bring relief from droughts which have been experienced for the past five years. It will mean the elimination of flood hazards to communities and farm lands adjacent to streams. It will minimize stream pollution and prevent the loss of soil through erosion, so common to rolling farm lands.

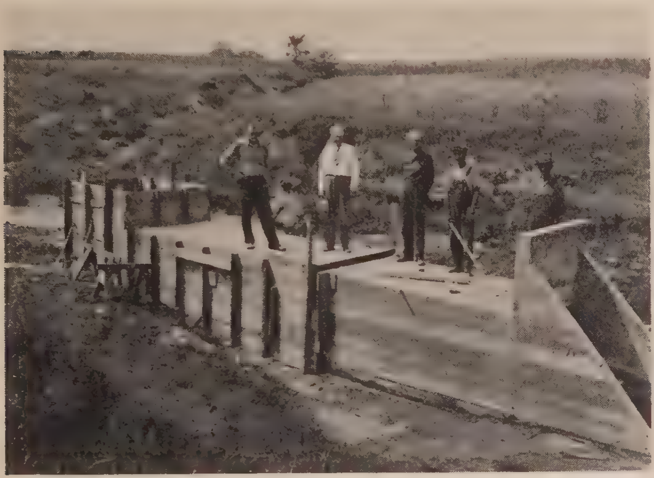


Figure 1. This tube type of dam, developed in Nebraska, is ideal for stopping erosion in ravines and gulleys. It is an earth-fill dam, but it utilizes concrete. Details are shown in the line drawing, Figure 2

Ground-Water Level Is Dropping

Why is water conservation important? Because our springs and wells are going dry and the fresh-water table is lowering and fast disappearing. Unless we can replenish this ground water and raise the fresh-water table, we are headed for real trouble.

There are two distinct types of water tables—one of fresh water and another of salt water. The latter, being lower in the ground, is subjected to rock pressure from below. When the fresh-water table is depleted or exhausted, it is replaced by salt water. If such an occurrence happens, the soil becomes arid and neither plant nor animal life can exist.

The average fresh-water level has dropped 13.8 ft. in the past 80 years. These figures were determined by the United States Bureau of Soils after a survey of 9,500 wells.

In Columbus, Ohio, at the Moores & Ross milk plant, the water table has dropped 30 ft. in the last 10 years; 30 ft. more and they strike sulphur water which can not be used for dairy purposes.

Ohio Well Now Pumps Salt Water

At the Buckeye Steel Castings Company plant it has dropped 3 ft. in the past year. The Bucyrus City reservoir has gone dry and that city has now been placed on a water ration program. The City of Galion is hauling water in tank cars. Lake Erie is now approximately 3 ft. below normal.

Here is another specific case which has considerable interest. In Scioto County a farm owned by a Mr. Jordan is located two miles from the Scioto River and two miles from the Ohio River. In 1925 a contract was let by the Ohio State Highway Department for a concrete road to

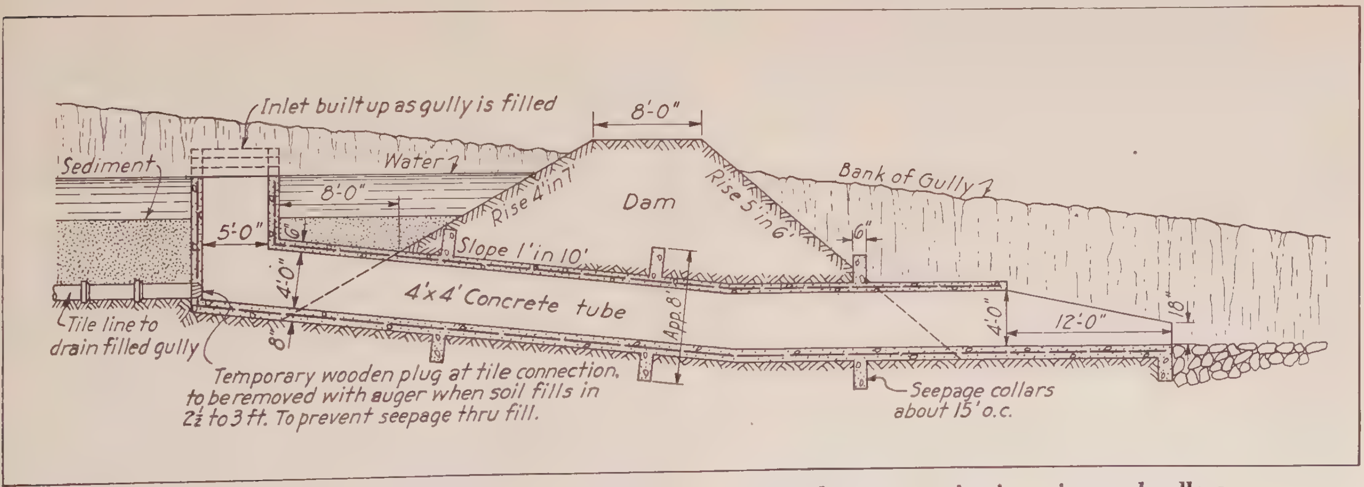

Inlet built up as gully is filled
8'-0"
Sediment
Water
8'-0"
Rise 4' in 7'
Dam
Rise 5' in 6'
Bank of Gully
5'-0"
6"
6"
Slope 1' in 10'
4'-0"
4'x4' Concrete tube
App. 8'
4'-0"
12'-0"
18"
8"
Tile line to drain filled gully
Temporary wooden plug at tile connection, to be removed with auger when soil fills in 2½ to 3 ft. To prevent seepage thru fill.
Seepage collars about 15' o.c.

Figure 2. Detail of earth-fill and concrete tube dam, designed to stop erosion in ravines and gulleys

pass this farm. The contractor asked Mr. Jordan for permission to use the water from his farm well. Mr. Jordan agreed, providing the contractor would take care of the water needs of the farm. The well at that time was 90 ft. deep. About 30 days after the contractor started pumping, the well turned salt and is salt today. It is now necessary for them to haul water for the needs of this farm.

How Water Supply Is Depleted

The average rainfall per annum for Ohio is 37 in. For the year 1934 it was 12.4 in. below normal. In passing, let us see where this rainfall comes from. Rain is caused by evaporation from the soil, trees, lakes, swamps, creeks, rivers and oceans. The evaporation from permanent water reservoirs and lakes in the Ohio region varies from 20 to 45 in. yearly, depending on weather conditions. The evaporation from forests is 6 tons of water for each ton of leaf that grows each year. Having cut the forests, drained the lakes and swamps, tiled most of the farms and ditches, we can not expect to have as much evaporation as heretofore, and consequently we shall have less rainfall. Therefore it is necessary to construct artificial reservoirs and lakes so that we can produce more evaporation.

Floods are one of the greatest menaces of life and property. The property damages in the Ohio Valley caused by the 1907 flood were $100,000,000, estimated by the Inland Waterways Commission. The property damages in the Ohio Valley caused by the 1913 flood totalled $180,000,000, and 415 lives were lost, according to a survey made by the United States Geological Department. The property damages in the Ohio Valley caused by the 1933 flood were approximately $100,000,000, as estimated by W. A. Julian.

Protection Against Floods

During the March (1933) flood, attention was focused on the possibilities of concrete walls for protection of cities, similar to that at Portsmouth, Ohio. The concrete wall surrounding that city efficiently protected it from this flood, which caused $100,000,000 damage to other cities in the Ohio Valley. The flood wall at Portsmouth was started in 1908. A second section was built in 1916, and the third and final section in 1930. The entire length of the flood wall is 14,681 ft. It utilized 30,000 cu. yd. of concrete.

Floods can be controlled by building dykes, levees and a reservoir system, either by the retarding or impounding type. The impounding type is considered more efficient from the standpoint of conservation because it helps to replenish ground water and thus raise the fresh-water table.

Vast Amount of Concrete Construction

Water conservation and prevention of soil erosion mean a great market to the concrete construction industry at this time. The structures involved include both earth and concrete dams. The earth dams utilize concrete for core walls, spill-ways and revetments. It is surprising to many that an earth dam may require from a few hundred to several thousand cubic yards of concrete.

Retaining walls, revetments, bridges and relocation of highways, railroads and towns are also included in a project of this kind. Another item is the construction of sewage disposal plants, which will be compulsory to prevent pollution of the waters that are to be impounded. Sewerage extensions and waterworks plant improvements will be needed, and each of these will require additional concrete construction work.

While the big structures are important, there will be a further and continuing need for an increasing number of smaller structures, such as check dams, cottages along the water's edge, septic tanks, sidewalks, driveways, and other small construction items.

Conservancy Districts Needed for Large-Scale Development

Individual land owners can accomplish much toward the conservation of their own water supply and the prevention of soil erosion through the construction of small dams, bulkheads and other small and inexpensive construction in which labor is by far the largest item. However, for successful conservation on a state-wide or sectional scale, the organization of conservancy districts becomes necessary. The first step in setting up a conservancy district is necessary state legislation; otherwise nothing can be accomplished. Ohio was the first state in the Union to adopt a conservancy act. This was passed on February 17, 1914, nearly a year after the 1913 flood.

After legislation is provided the idea is taken up by chambers of commerce and other civic organizations such as Rotary, Kiwanis and Lions Clubs, and by newspaper editors, fish and game organizations, the Izaak Walton League, departments of public health, farm bureaus, granges, state planning boards, water conservation boards, and city officials. The support of these groups is extremely important, and necessary to the success of an undertaking. Sometimes the best support is given by prominent citizens.

Public Campaign of Explanation

After the support of these organizations has been obtained it may then be necessary to carry on a public campaign to explain the plan to the people.

It is then necessary to form one water conservation association. After this group has been formed, petitions must be circulated asking the proper political authority that this community be organized into a conservancy district under the state law. The first project in a state to be selected for promotion should be the one which has the best chance of success. In the next issue of CONCRETE I shall describe how the work in Ohio was actually set in motion.

(To be concluded in next issue)

Book on Concrete Form Work

Every contractor needs this book on "Concrete Form Work," by A. B. MacMillan, chief engineer of the Aberthaw Company, a large eastern construction company.

This 64-page book contains large and clear-cut details of form work for all phases of building construction, including form work for architectural concrete.

The Book Department of *Concrete* has a limited number of copies left. Any contractor can get a copy free, while the supply lasts, as a premium with one year's subscription to *Concrete*, or a year's extension to his present subscription.

EDITORIAL

Thirty Years of Concrete-Making

This year's annual meeting of the American Concrete Institute marks the 30th anniversary of the founding of that organization, in a day when concrete had only begun to gain a foothold in this country.

During these thirty years the leaders in the development of concrete, as we know it today, have found in the Institute a powerful guiding force. Through the interchange of ideas made possible by the existence of the Institute, these men have kept themselves informed of what their fellow-workers were doing. New facts about concrete, once brought to light, by one researcher, soon gained support from further investigations by others. Conversely, when one of these quests for facts led the researcher off on the wrong path, his brethren had a means of convincing him of his error.

All men of the concrete construction industry, whether researchers or, designers or men engaged in the practical every-day use of concrete, will find a wealth of new interest in the forthcoming annual meeting in New York. The program covers a broad scope in itself; but the greatest advantage, as always, lies in the opportunity to meet and mingle with the leaders of all branches of the industry—from the manufacturer of cement to the final user of this product in the form of concrete.

The concrete industry as a whole will have much to gain from the New York meeting. What the individual gains from it will depend upon himself—whether he attends the meeting or whether he stays at home.

Concrete Products in the President's Program

The concrete products industry is very much alive to the opportunities offered by the President's great federal public works construction program, presented to the present Congress. This becomes evident from examination of the convention programs—printed in this issue—of the forthcoming annual meetings of the National Concrete Masonry Association and the National Cinder Concrete Products Association. Both conventions are to be held in New York during the present month.

The program of the Concrete Masonry Association, in particular, is replete with papers and talks designed to show the many places where concrete masonry construction fits into the federal plans.

Markets for concrete building units will be certain to arise from this enlarged national plan, especially in the construction of slum clearance projects, in subsistence homestead developments, and in other forms of low-cost housing. Other markets for concrete products such as septic tanks, sewer pipe and drain tile, will be found in projects for soil and water conservation, and in the construction of sewage disposal-plants.

It is estimated that in the single field of home construction the federal public works program will stimulate directly more than eighty industries. Many others will see favorable effects from other parts of the program; but few industries are in a position to gain the direct benefits that should be enjoyed by the concrete products industry.

Concrete Colors in Original Package

Architects who have specialized in the use of concrete as an architectural material are satisfied with every phase of architectural concrete except color. This assertion was made recently by A. J. Boase, manager of the structural bureau of the Portland Cement Association, following his interviews with a number of Pacific Coast architects.

These architects want to know how they can specify colors so as to get the kinds and shades desired. Both the architect and the contractor want to be assured that the colors purchased for the work are the colors called for in the specifications.

What this means is that many Pacific Coast architects and contractors have had some unfortunate experiences with color. It means also that manufacturers of colors intended for use in architectural concrete must solve this problem in a way that will remove all doubt as to the quality of the colors that are delivered to the work.

This can be done if containers are marked so as to indicate that the contents are suitable for use in concrete, and if the contractor himself can be sure that he is buying the colors in the manufacturer's original package.

Details may vary; but these fundamental requirements must be kept in mind.

Low-Cost Homes the Chief Weapon

Secretary Ickes has referred to the low-cost housing plans in the President's $4,000,000,000 federal public works program as the chief weapon in this year's war on unemployment.

Fortunately, this part of the great drive for recovery will reach all sections of the country. It will reach the large cities with the plans for slum clearance, and it will reach rural sections with subsistence homesteads and with additional large-scale projects of the type of the TVA.

The federal government, having gone through the experimental stages, is in a position to bring such projects rapidly to the stage of actual construction.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Experimenting with Isteg Bar

A LARGE Eastern steel company is experimenting with the "Isteg" type of reinforcing bar (see CONCRETE, May, 1934, page 12). The supply of bars thus far rolled are intended for experimental purposes only. The product is not as yet being offered to the trade.

The "Isteg" bar is a double stranded bar made by twisting together two bars of mild steel, one result being a greatly increased yield point. This type has been in general use in Europe for six or seven years. Prussian regulations permit a working stress of 25,500 lb. per sq. in., compared with 17,000 lb. for plain bars.

Reinforcing Bar Standards Reaffirmed

THE division of simplified practice of the National Bureau of Standards has announced that Simplified Practice Recommendation R26-30, Steel Reinforcing Bars, has been reaffirmed, without change, by the standing committee of the industry.

This simplification program, which was proposed and developed by the industry, reduced the number of cross sectional areas of reinforcing bars from 32 to 11, and limits the equivalent cross sectional areas of the bars to two decimal places.

Research Work of A. S. T. M. Committees

RESEARCH activities going forward under the direction of various committees of the American Society for Testing Materials include the following:

Studies of Concrete Aggregates (Committee C-9).—A study of the various properties of aggregates for concrete, including soundness, resistance to abrasion, absorption and influence of shape, fineness and soft particles on quality of concrete; also freezing-and-thawing tests. Tests developed for soundness of aggregates and for absorption of aggregates (field and laboratory methods), see *Proceedings,* Vol. 33, Part I, p. 286 (1933).

Deleterious Substances in Concrete (Committee C-9).—A study of the various naturally or accidentally occurring materials in concrete which may affect it deleteriously. See abstract of unpublished paper by C. L. Ford on "Comparison of Standards for Colorimetric Test for Sand," preprint, 1934 Report of Committee C-9. Current studies not yet reported.

Curing of Concrete (Committe C-9).—Co-ordination and study of results of investigations of the curing of concrete, looking ultimately to recommended methods of practice or specifications for curing. Five specifications adopted for various types of curing concrete. Specifications prepared for sodium silicate for curing. See preprint, 1934 Report of Committee C-9. Present studies include effect on warpage, curing of concrete in structures and test for efficiency of curing material.

Workability of Concrete (Committee C-9).—A study of the significance and methods of determining workability of concrete. See *Proceedings,* Vol. 29, Part I, p. 297 (1929). Recent work not yet reported.

Admixtures in Concrete (Committee C-9).—A general study of admixtures which may be added to concrete for the purpose of improving some of its properties. Progress report, see *Proceedings,* Vol. 29, Part I, p. 305 (1929), containing a summary of manufacturers' data on various commercial admixtures. Recent work not yet reported.

Elastic Properties of Concrete (Committee C-9).—Studies of the elastic properties of concrete of different mixtures at different ages under different conditions of moisture, the effect of different aggregates, a determination of the modulus of elasticity of concrete in tension, establishment of Poisson's ratio, and of the effect of application of loads, type of bearing, sensitivity of measuring devices, etc. See paper by R. E. Davis, H. E. Davis and J. S. Hamilton on "Plastic Flow of Concrete Under Sustained Stress" (not preprinted), see *Proceedings,* Vol. 34, Part II (1934).

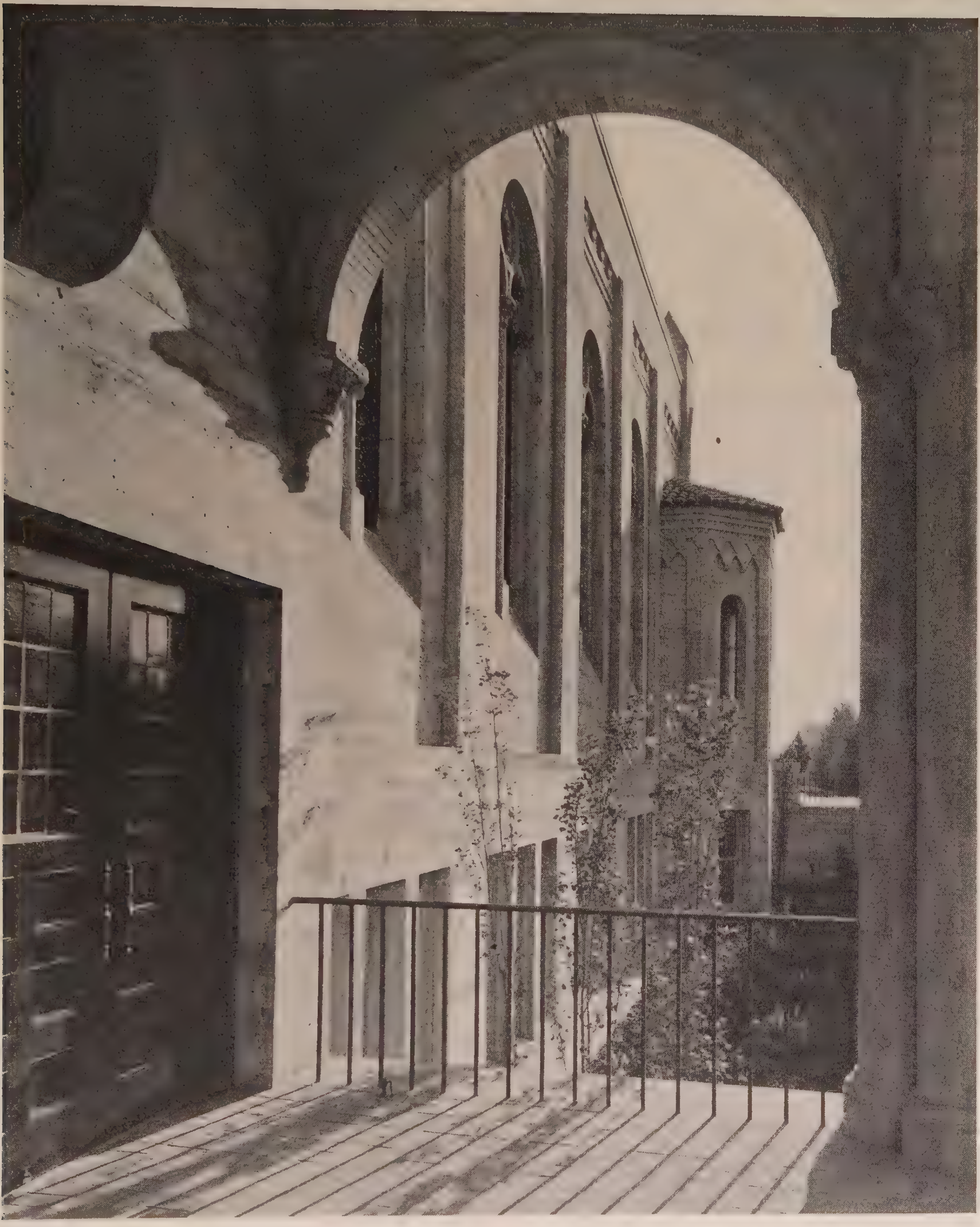
Permeability of Concrete (Committee C-9).—Study of the literature followed by studies of various methods and apparatus including the significance of permeability and absorption of concrete and the value of blended cements in reducing permeability. See "A Study of the Permeability of a Few Integrally Waterproofed Concretes," by W. M. Dunagan and G. C. Ernst, preprint, 1934 Report of Committee C-9.

Conditions Affecting Durability of Concrete in Structures (Committee C-9).—Study of the conditions under which concrete has not been durable. It will emphasize the precautions which must be taken to produce good concrete, whether in methods, material or workmanship. Studies of freezing-and-thawing tests. For report on the examination of concrete structures in Ontario and Quebec, together with observations and conclusions, see *Proceedings,* Vol. 30, Part I, p. 686 (1930). See paper by B. Kellam on "The Action of Water on Concrete," *Proceedings,* Vol. 33, Part I, p. 289 (1933).

Methods of Analyzing Concrete (Committee C-9).—Development of test methods for the quantitative determination of the constituents of concrete. Tentative method developed for routine analysis of the cement content of hardened concrete. Proposed draft of Dunagan method of field determination of the constituents of fresh concrete published as information, see *Proceedings,* Vol. 31, Part I, pp. 362, 383 (1931). See also paper by H. R. Nettles and J. M. Holme "A Study of the Analysis of Fresh Concrete with the Dunagan Buoyancy Apparatus," *Proceedings,* Vol. 33, Part I, p. 297 (1933).

Field Tests for Concrete (Committee C-9).—Standardization of methods of making field specimens, including sampling of the concrete when soft, the methods of sampling hardened concrete, and the development of field tests for concrete. Study of relation between the strengths of test specimens of different forms and dimensions. Relation between the compressive strength of test cylinders made in accordance with the A. S. T. M. standard method and prisms removed from slabs of the same mix. Methods of testing vibrated concrete and an accelerated compression test being studied. Tentative method of transverse testing developed. Recent work not yet reported.

Architectural Concrete



Allison & Allison, *Architects*

Monolithic concrete, with all form marks showing, was the architectural medium employed to get this effect in the First Baptist Church, Los Angeles, Calif. The width of the form boards and the great care taken in constructing the form work play important parts in the effect produced

Figure 1. Well-built concrete brick plant, one of six in the London area, creates confidence in the product

Home Construction Pulled England Out of Depression

American Concrete Brick Machines Play Big Part in Supplying Materials—Many Industries Stimulated by 350,000 New Houses in 1934

By W. E. DUNN
President, W. E. Dunn Manufacturing Co., Holland, Michigan

THE building industry pulled England out of the depression—and what has happened in England during the past few years, with building construction in a constant upward climb, is precisely what actually has been started in the United States.

Building Industry Is Leading Us Out

The assertion just made can not be successfully disputed, for there are many unmistakable indications that the vast government-supported program for residential modernization and construction has started things on the up-grade. The great volume of home modernization already completed and in progress under the direction of the FHA has produced a wholesome and much-needed activity in the building industry, although for the most part these small but numerous projects are not included in construction statistics. Now that the FHA is working with the utmost energy toward stimulation of new residential construction, and the government's new $4,000,000,000 construction program, when passed by Congress, will include huge expenditures for slum clearance, for group residential developments, and for subsistence homestead projects, who can deny that big things are in the air? Just as in England, the building industry will lead—and is leading—the United States out of the depression.

England's Broad Construction Program

A glance at the construction program in England will give us an interesting picture of what may be expected in this country. The steady progress of building construction in that country during the last few years has accelerated into a boom of considerable proportions, bringing indirect benefits to 80 other industries or trades. It has spread to all parts of England, and now one hears, on every side, stories of shortages of material and labor; of employers asking men to work overtime; of contractors gladly paying premiums for quick delivery.

Figure 2. One of huge housing projects under construction by the Staines Estate, Surrey (England). Concrete bricks are being used

Construction of buildings is being carried forward by private enterprise, this phase of the program including individual buildings, dwellings or factories, and the development of private residential estates by large contractors or by companies formed for the purpose. Then there is the large-scale residential construction undertaken by Local Authorities, and the gigantic task of slum clearance.

How Other Industries Are Stimulated

Some 350,000 new homes were built by these various forces in 1934—a larger number than in any preceding year. The Building Industries Council (London) estimates that the erection of these 350,000 houses utilized the quantities of materials shown in the accompanying table.

QUANTITIES OF MATERIALS REQUIRED FOR CONSTRUCTION OF 350,000 HOUSES IN ENGLAND IN 1934

Bricks	6,000,000,000
Cement	4,592,000 Bbls.
Timber	118,000,000 Bd. ft.
Lead	75,000 tons
Cast iron pipes	25,000,000 ft.
Drain pipes	21,000,000 ft.
Cisterns	1,000,000
Baths	330,000
Boilers	330,000
Grates and ranges	1,700,000
Doors	3,000,000
Glass	37,000,000 sq. ft.
Putty	8,300 tons
Floor tiles	92,000,000

Little imigination is required to visualize the enormous influence which the production of these building materials has exerted on business recovery in England. It is an amazing fact that the clay brick manufacturing plants in that country have been unable to supply the demand for bricks, and that 237,000,000 bricks and 830,000,000 tiles were imported in 1933. Imports in 1934 have not yet been announced, but will surely be greater.

See Opening for Concrete Brick

Arthur F. Echberg, a native of Australia and an international figure in the construction industry, must be credited with the vision to see that the situation in England provided an almost perfect set-up for the introduction of concrete brick manufacture on a mass production scale. In his native country he was actively engaged in the concrete products business. During a visit to the United States a few years ago he became interested in the concrete brick machinery manufactured by the company headed by the writer, at Holland, Mich. He was impressed at once with the possibilities presented by the growing building boom in England. He went on to England, and his belief was confirmed by his investigations. With his intimate knowledge of the machines and their product he was able to win the interest of an influential group of men connected with the concrete products business.

This group included William Prince, formerly managing director in England for the Texas Oil Company, and Thomas J. Russell and John R. Roberts, both connected for many years with a firm which started in the concrete products business a number of years ago, and now controls assets running into millions.

A Typical Market for Concrete Brick

A typical illustration of the wide doors open to concrete brick was seen in a survey made in the city of Leicester, showing an urgent need for 2,500 new homes. Here was a market for 50,000,000 bricks. Abundant money was available at a low interest rate, for the construction of these homes, but the whole undertaking had been delayed because the available supply of clay brick was wholly inadequate and deliveries were slow. In contrast, it was found that concrete bricks could be produced locally, by local labor, because unlimited quantities of excellent sand and crushed granite were available. Here, again, one can not refrain from the comment that many similar situations exist in the United States.

Six Plants Built; Thirty Planned

The result of the initiative taken by Mr. Echberg is that the group headed by him, organized under the name of Concrete Building Commodities, Ltd., has built six standardized concrete brick plants at strategic points around Greater London, and plans are being prepared for the erection of 30 additional plants. The writer spent some months in England, aiding in the study of potential markets and the location of plants.

The exterior view of the plant shown in Figure 1 emphasizes an important point that is too often overlooked by American manufacturers of concrete products. In contrast to the slovenly appearance of so many American concrete products plants, these plants have the appearance of establishments where only products of high quality are manufactured. This has an extremely favorable effect on architects and contractors who visit the plants.

Build Factories with Own Product

The method adopted in building these plants is to set up the machines, put them to work, then build the factory around them by using their own products.

Raw materials are carefully selected and graded, properly proportioned and thoroughly mixed, and the finished product is steam-cured—and another point of great importance is that the cost of manufacture is less than that of clay brick.

Let me repeat that England is fighting her way out of black depression, and that the building industry is one of the biggest factors in this recovery. The splendid prospect for parallel development in the United States, now made possible through the FHA and other federal agencies, and through the much greater program now proposed to Congress, should receive the greatest encouragement from the achievements realized in England.

National Ready-Mixed Concrete Association in Fifth Annual Meeting

THE fifth annual convention of the National Ready-Mixed Concrete Association is in session at the Palmer House, in Chicago, on January 31 and February 1, as this issue of CONCRETE is going to press.

At the morning session of January 31, H. F. Thomson, president of the association, told of the state of the industry and explained a new plan of organization adopted last June by the board of directors. R. B. Young, of Toronto, discussed the technical problems of the ready-mixed concrete industry, and the plans for their solution as proposed by a committee headed by him. This was followed by 5-minute discussions of "business conditions at home," by members from various parts of the country.

On the afternoon of January 31 the delegates attended the joint session of the three national aggregates associtaions, in annual convention at the same hotel, and in the evening they joined the same groups in a combined banquet.

At the morning session of February 1, President Thomson outlined the association's proposed activities for 1935. F. R. McMillan, of the Portland Cement Association, presented a paper on "Trends in Cement Specifications," after which Prof. F. E. Richart, University of Illinois, discussed the use of high-strength concrete in certain types of structures, in a paper entitled "The Economics of High-Quality Concrete in Reinforced Concrete Structures." This was followed by an open forum of 5-minute discussions of developments in ready-mixed concrete equipment and of the marketing problems of the industry. Also, at this session, the board of directors presented the annual report.

In the afternoon of February 1 there was an open meeting of the Code Authority for the Ready-Mixed Concrete Industry, for a full and free discussion of code problems. This session was followed by another meeting of the Code Authority on Saturday morning, February 2, also an open meeting. This was primarily a business session, but there was also a discussion of the year's activities of the Code Authority.

Federal Public Works Construction to Create National Wealth

President's Message to Congress Lists Slum Clearance, Subsistence Homesteads, Highway Construction, Grade Separation, State and Municipal Public Works, and Soil and Water Conservation, as Parts of Huge New Construction Program

THE President's message to Congress, delivered on January 4, contains no proposal that is of greater import to the entire nation than the plan to give work to the remaining unemployed "employables" through his emergency public works construction program.

This "single new and greatly enlarged plan," as he calls it, involves a vast volume and great variety of construction work, all of it of such character that it adds to the national wealth without seriously competing with private enterprise.

Summary of Government Program

What all this means to the construction industry may readily be determined from the following summary of the principal types of projects to be included in the program:

(1) *Clearance of Slum Areas*—The great variety of materials utilized in structures of this character will result in the stimulation of some eighty industries.

(2) *Subsistence Homesteads*—These projects will involve not only the construction of homes and the consequent stimulation of many industries, but also the construction of roads and streets, the installation of simplified water-supply systems, and the construction of sewerage systems and sewage-disposal facilities.

(3) *Highway Construction*—Improvement of existing road systems, and the construction of national highways designed for the needs of modern traffic and modern highway transportation, will be included in this group.

(4) *Grade Separation*—The elimination of grade crossings will require the construction of thousands of permanent engineering structures.

(5) *State and Municipal Public Works*—So far as possible, projects under this group are to be self-liquidating, the federal government supplying the funds for the construction of projects such as waterworks, light and power plants, sewerage systems and sewage disposal plants.

(6) *Rural Electrification*—Extension of electric light and power to rural areas will require not only the construction of new transmission lines, but the further development of hydro-electric power, with the consequent construction of numerous dams and power plants.

(7) *Soil and Water Conservation*—Here a large part of the work will consist of moving earth, placing revetments, and the like; but these projects will also involve the construction of a great number of dams, both large and small, the relocation of railways and highways, the demolition and reconstruction of buildings, and often the moving of entire towns.

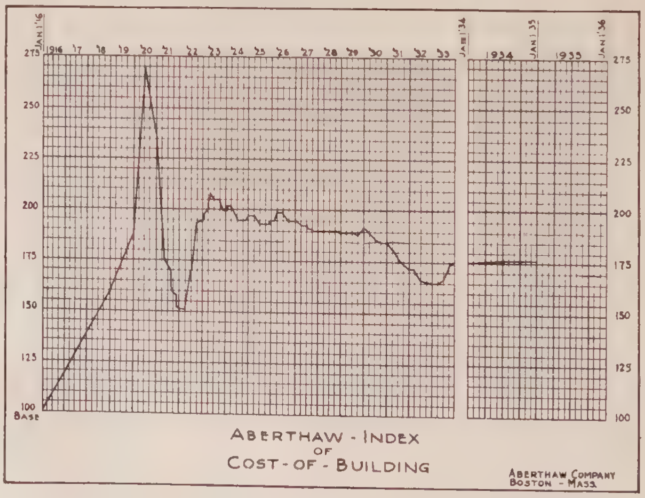
(8) *Reforestation of Watersheds*—The reforestation of principal watersheds will, in many cases, be carried on in conjunction with soil and water conservation projects. In addition to planting, it will require much attention to the prevention of further erosion of soil.

(9) *Extension of the CCC*—Extension and enlargement of the work of the civilian conservation corps will doubtless be directed along the lines of the present activities of that organization, including reforestation, soil and water conservation, and other work of this character.

Let it be repeated that this great program is not in competition with private enterprise, with the possible exception of municipal power and light plants in paragraph (5). As to slum clearance and subsistence homestead developments, these are clearly of such a nature that private capital can not undertake them without some form of governmental aid and control. Furthermore, it is certain that the federal government alone can push these projects to the construction stage in time to be of aid in business recovery.

Aberthaw Index of Building Cost

THE Aberthaw index of the cost of industrial building, for the quarter ending December 31, 1934, remains at 176.5, the same figure as on June 30 and September 30, 1934. This indicates that construction costs throughout the past year were well stabilized.



This index value represents a cost of $1.85 per sq. ft. of floor area for the 7-story reinforced concrete industrial building on which the index computations are based.

Design Earthquake-Proof Buildings by Attention to Details

Post Office Building at Redwood City, Calif., Complies with Fundamental Principles—Monolithic Superstructure on Reinforced Concrete Mat

By JACOB J. CRESKOFF
Consulting Engineer,[1] Philadelphia, Pa.

WHAT constitutes an adequate earthquake-proof building design? Naturally, one which evaluates the forces acting on a building during an earthquake, and designs the principal elements and details of the building to endure these forces without undue strain.

In the past it has been customary to assume that earthquake forces are static, and may be estimated by statical methods. In general, the statical method assumes that buildings are vertical cantilevers subjected, during earthquakes, to a static horizontal force equal to a percentage of the dead and live loads above the section under consideration. The percentage chosen for any case depends on the distance of the site from seismically active faults or rifts, and on the type of soil encountered.

Earthquake Forces Are Dynamic

Earthquake forces, however, are not static, but are dynamic. While the statical method yields results which may be permissible for low and unimportant buildings, in the sense that they are on the side of safety, only the dynamical method will give an accurate picture of what may happen to an important building during an earthquake.

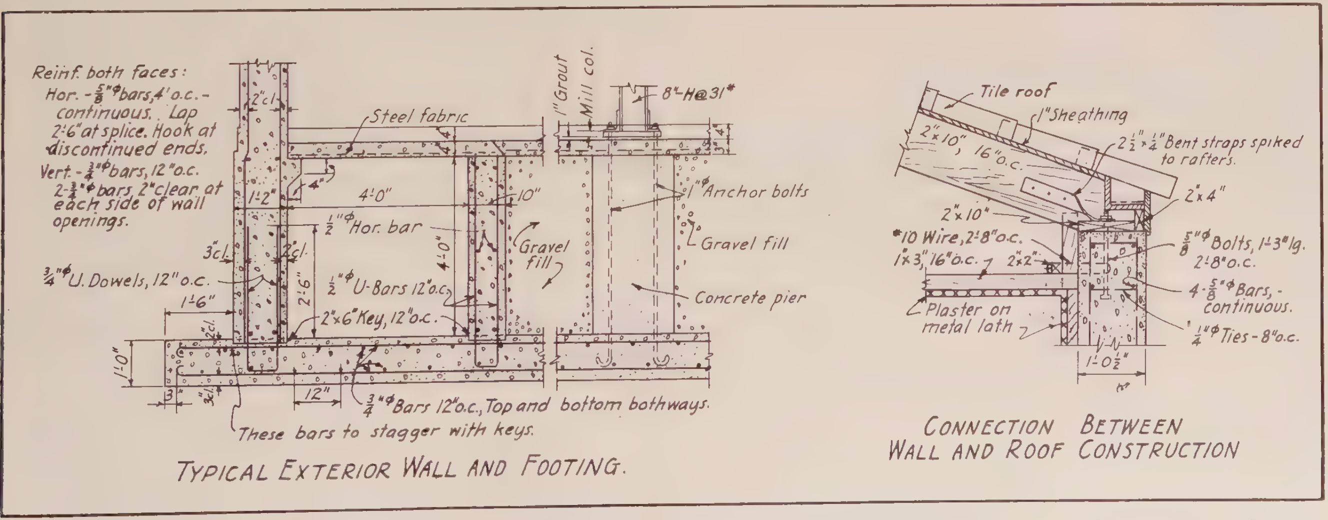
The dynamical method, therefore, recognizes that earthquake forces are dynamic in character. In common with the statical method, the proximity to faults and rifts, and the type of soil, are investigated. In addition, the dynamical method takes into account the probable seismic motion of the site, the nature of the grip of the site on the foundation, and the effect of synchronism between the earthquake, site, and building vibrations, the latter being of profound importance in determining the location and amounts of the maximum moments and shears.

When an earthquake occurs, sites and buildings are thrown into vibration, the nature of which depends on the characteristics of the earthquake, and site materials; on the site's grip on the foundation; on the depth of the foundation; on the synchronism between the seismic forces, and site and building vibrations; and on the strength and rigidity of the building. In general, the more intense the earthquake, the more moist and loose the soil, the firmer the grip on the foundation, the shallower the foundation, the closer the synchronism between earthquake forces, and site and building vibrations, the weaker and more flexible the buildings—the more violent will the vibrations of the building be.

Reducing Vibrations of Buildings

Violent building vibrations, of course, are undesirable for several reasons. How, therefore, may these be reduced? From the previous paragraph it seems theoretically possible to reduce building vibrations during an earthquake to a minimum by—

(a) Breaking the grip of the soil on the foundation.
(b) Building foundations deeper below the surface.
(c) Avoiding synchronism between earthquake forces, and site and building vibrations.
(d) Increasing strength and rigidity of the building.
(e) Picking a site composed of dry, firm soil.


Reinf. both faces:
Hor. - 5/8"φ bars, 4' o.c. - continuous. Lap 2'-6" at splice. Hook at discontinued ends.
Vert. - 3/4"φ bars, 12" o.c.
2-3/4"φ bars, 2" clear at each side of wall openings.
2" cl.
Steel fabric
4"
1'-2"
4'-0"
10"
1/2"φ Hor. bar
3" cl.
2" cl.
2'-6"
4'-0"
Gravel fill
3/4"φ U. Dowels, 12" o.c.
1/2"φ U-Bars 12" o.c.
1'-6"
2"×6" Key, 12" o.c.
2" cl.
1'-0"
3"
3" cl.
12"
3/4"φ Bars 12" o.c., Top and bottom bothways.
These bars to stagger with keys.
TYPICAL EXTERIOR WALL AND FOOTING.
1" Grout
Mill col.
8" H @ 31#
3"
4"
1"φ Anchor bolts
Gravel fill
Concrete pier
Tile roof
1" Sheathing
2"×10", 16" o.c.
2 1/2"×1/4" Bent straps spiked to rafters.
2"×4"
2"×10"
#10 Wire, 2'-8" o.c.
1"×3", 16" o.c.
2"×2"
5/8"φ Bolts, 1'-3" lg. 2'-8" o.c.
4-5/8"φ Bars, - continuous.
1/4"φ Ties - 8" o.c.
Plaster on metal lath
1'-0 1/2"
CONNECTION BETWEEN WALL AND ROOF CONSTRUCTION

At left, showing how exterior concrete walls are keyed and doweled to reinforced concrete mat. At right, connection between wall and roof construction on Redwood City Post Office Building

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[1] Author of *Dynamics of Earthquake-Resistant Structures*. Consultant on Aseismic Design, Procurement Division, United States Treasury Department.

The site is usually provided, and can not be changed. Considering the remaining possibilities, it is obvious that very deep foundations, as well as excess strength and rigidity, will be very costly. However, decreasing the site's grip on the foundation is not only relatively inexpensive, but also provides a simple way of altering the mode of vibration of the building, and consequently the chances of synchronism between seismic forces, and site and building vibrations.

During a destructive earthquake—and incidentally, the United States Coast and Geodetic Survey Department records show that there is probably no part of the United States and its possessions which has not experienced such earthquakes in the past, or which is immune to such earthquakes in the future—the damage to buildings is, in general, directly proportional to the quality of the design, materials, and construction. Destructive earthquakes occurring among buildings of inferior design, materials, or construction are much to be feared. On the other hand, buildings designed and constructed in accordance with correct aseismic principles will survive such earthquakes undamaged.

Causes of Collapse

A composite picture of earthquake damage shows that one of the most frequent causes of building collapse is an inadequate foundation. Poorly constructed walls of brick, tile, blocks, or stone, fail. Inferior mortar is dangerous. Unanchored roof trusses are factors in failure. Porches, cornices, parapets, veneers, and ornamentations tear loose. Plaster and tile partitions fail. Unbraced buildings collapse, or suffer considerable damage to walls and partitions. Floors break up, if foundations settle unevenly. Steel frames, or reinforced-concrete frames, with brick, tile, block, or stone walls suffer damage if the walls are fractured; those with adequately designed reinforced-concrete walls stand up well. It is repeatedly revealed that inferior design, materials, or construction offer little resistance to damage by earthquake.

The foregoing paragraphs give the clues as to how buildings are made earthquake-proof. In brief, the method consists of determining analytically the mode of vibration of buildings, and determining how they will stand up under destructive seismic forces.* In addition, theory and experience dictate that the following general specifications be utilized.

Details of Earthquake-Proof Design

Thus, if a fault or rift passes through a site, it would be inadvisable to locate an important building there, for in the event of a major earthquake it is highly probable that the building would be destroyed. Again, an adequate foundation is a vital factor in earthquake-proof building design. Particularly is this so, if the soil is of questionable character. The ideal aseismic foundation is a reinforced-concrete mat. If this is out of the question, then the footings should be interconnected by beams able to keep them at the same relative elevation during an earthquake.

Also, reinforced-concrete floors and walls, and metal lath partitions, are to be preferred. Chimneys should be of reinforced-concrete, or of sheet metal. Monolithic construction is desirable. Materials used must be of first quality. Finally, the fundamentals of a satisfactory design are symmetry of plan, mass, and rigidity, and that type of design and construction which will insure that the building and its component parts will vibrate together as a unit, during an earthquake.

Redwood City Post Office Building

The Redwood City, California, Post Office Building is in a region of considerable seismic activity. The site is located near Redwood Creek, and its easterly portion was formerly low ground, and subject to flooding during extreme high tide, and on occasions when excessive storm water run-off and high tide in Redwood Creek occurred simultaneously. The fill has been in place for several years, and the present surface is above high water mark. Rock occurs here at a depth of approximately 100 ft. So far as is known, there are no faults or rifts through the site.

Four test holes were dug. These disclosed a variable soil of doubtful bearing value, consisting of adobe, fill, sandy clay, soft blue muck, sand and gravel, and mixtures thereof. In view of the nature of the native soil, it was decided to use a reinforced-concrete mat foundation.

Foundation Is Reinforced Concrete Mat

The structural features of the building consist of a reinforced concrete mat foundation designed as a horizontal girder, reinforced concrete walls designed as vertical beams against the horizontal seismic forces, reinforced concrete piers, structural steel columns, and steel roof frame. Between the top of the mat and the bottom of the first floor slab is a gravel fill. This was used primarily because it effects a saving of first floor beam-and-slab system, the first floor slab resting directly on the gravel fill. Incidentally, however, the fill lowers the center of gravity of the building, and thus gives it greater stability.

Attention is directed to the drawing, showing the manner in which the roof is fastened to the walls, and the walls keyed and dowelled to the mat. These and other details of the frame insure that the building will vibrate as a unit.

Since destructive earthquakes usually disrupt the municipal water supply systems, with the result that protection against fire may be lacking, an independent, earthquake-proof water supply system will be installed in the building.

Design Complies with California Regulations

Analysis of the building design shows that it satisfies the maximum California earthquake requirement that the structural elements can withstand safely a horizontal force of one-tenth the weight of the building above the section under consideration. The plans of this building contain, to a considerable degree, all of the essentials of adequate, earthquake-proof building design, and it is predicted that the building will suffer only minor, if any, damage during a destructive earthquake.

Acknowledgments. — The plans were designed by the personnel of the Procurement Division, U. S. Treasury Department, under Admiral Peoples, Director; L. A. Simon, Supervising Architect; G. O. Von Nerta, Supervising Engineer; T. C. Brooks, Engineer of Design; and the author, Consultant on Aseismic Design.

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*See the author's Dynamics of Earthquake Resistant Structures, McGraw-Hill Book Company, New York, N. Y.

Can Quantities in Concrete Bridges Be Estimated From Diagram?

Idea Suggested by Waddell's New Charts for Steel Bridge Quantities—A Challenge to Ingenious Engineers

By DR. E. LEE HEIDENREICH
Consulting Engineer, Kansas City, Missouri

IS it possible to develop diagrams which can be used to determine within close limits the quantities of materials in reinforced concrete bridges, in advance of the design? If so, the same diagram could be used for checking the quantities taken from completed plans.

The writer believes that some one among the more ambitious and talented readers of CONCRETE can devise such diagrams if he sets himself to the task.

This idea came to my mind recently, when my friend, Dr. J. A. L. Waddell, the universally recognized bridge construction authority, spent a few hours in my office and took occasion to show me his new diagram for computing the cost of single and double-span steel bridges based upon span and standard loading. The result was startling. The weight of steel for the finished bridges came out within less than one per cent of actual weight.

How Steel Bridge Diagram Is Made

The idea might well be used for checking quantities in reinforced concrete bridges, as will be understood from the following description of Dr. Waddell's chart.

The span lengths are shown as the abscissas in a cross-sectional diagram on which there are two sets of curves, one set based upon the total dead, live, and impact load on single and double-track railroad bridges of silicon steel of high elastic limit. All loads are standard loadings now in general use. On the right side of the diagram the ordinate shows the percentage of the total bridge load representing the weight of steel in that particular span.

For instance, for a 400-ft. span a vertical line above 400 will intersect either curve and a horizontal line from the intersection to the percentage ordinate will show, say 32 per cent of the total load as the weight of steel.

Dr. Waddell and his assistants having based the curves on actual results of a great number of finished bridges, he tells me that his curves now are used not only as the basis for estimates, but for actual bidding. The diagram will be published in the proceedings of the A.S.C.E.

Similar Diagram for Concrete Bridges

Now for a similar diagram for reinforced concrete bridges we have two curves, one for arch bridges, one for girder bridges.

Inasmuch as the steel reinforcement in either type is a function of the concrete yardage, let the right-hand ordinate for steel requirement be a percentage of the yardage shown on the left-hand ordinate, and let the curves show the total dead, live, and impact loading on different spans for standard highway practice.

Even the cost of form work is a function of the yardage, so this cost may be represented in some way as well.

Such a diagram, applying to reinforced concrete bridges, would be of immense value to consulting engineers, and to highway and municipal engineers, all of whom are frequently called upon for "preliminary" estimates of cost of bridges for which plans have not been prepared. Guess-work could be eliminated at least from the superstructure part of the bridge. As in the case of Dr. Waddell's chart for steel bridges, the diagram could also be used for checking the quantities taken from working plans of concrete bridges.

[CONCRETE *will be glad to publish a chart covering reinforced concrete bridges, in line with the foregoing suggestions by Dr. Heidenreich. It is perhaps unnecessary to add that such a chart must be based on actually known quantities in a large number of bridges.*—EDITOR.]

Mississippi Valley Highway Officials Meet

IN its twenty-seventh annual meeting, at the Stevens Hotel, in Chicago, the Mississippi Valley Conference of State Highway Departments is in a three-day session beginning on January 31 and ending on February 2.

This Association is composed exclusively of the principal officers and engineers of the state highway commissions and departments and those county highway engineers whom the executive officers of the state highway departments may invite from the following named states and the U. S. Bureau of Public Roads: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Ohio, Kentucky, Tennessee, Arkansas, Mississippi and Louisiana.

Practically all of the technical sessions are being held on January 31, the various groups holding their meetings in separate rooms. These include (a) the administrative officers' group, (b) the construction engineers' group, (c) maintenance, traffic and equipment engineers' group, (d) bridge engineers' group, (e) design engineers' group, and (f) material and testing engineers' group.

Many subjects of interest to the concrete highway construction industry are under discussion, and some of the most valuable of the papers will be reproduced in forthcoming issues of CONCRETE.

Vault Association Meets in April

THE annual meeting of the National Concrete Burial Vault Association will be held on April 23 and 24 at the Statler Hotel, Cleveland, Ohio. J. H. Stuart of Bremen, Ohio, is secretary and treasurer.

HOW TO DO IT

◆ Questions and Answers ◆
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Book on Cement Stucco

Can you refer me to a reliable book of instructions on placing cement stucco?—B. T., Phoenix, Ariz.

An excellent book on this subject is published by the Portland Cement Association, 33 W. Grand Ave., Chicago, under the title "Portland Cement Stucco." Copies are supplied free to those who request it, by writing to that association.

Pozzolanic Cements Available

Are there any cement manufacturing plants in the United States that produce pozzolanic cement on a large scale, for the general construction market?—M. R. D., Chicago, Ill.

Some cement manufacturing companies are in a position to supply pozzolanic cements on special orders, either in small quantities for experimental purposes or in larger quantities for construction work.

Protecting Colored Concrete Floors

What is the best practice in protecting colored concrete floors, during construction operations, from damage by other trades?—M. J. F., Amarillo, Texas.

Finished concrete floors, whether colored or not, should always be protected during construction operations by keeping them covered with several layers of building paper until all other crafts have completed their work. Otherwise the floor may acquire stains and blotches that can not be removed.

Specifications for Cement-Bound Macadam Pavements

Where can I obtain a standard specification for cement-bound macadam roads and street pavements? —O. B. P., Bozeman, Mont.

The most up-to-date specification available is the "Specification for Cement-Bound Macadam Pavement," printed as one of the sections in a 24-page booklet entitled CEMENT-BOUND MACADAM, published by the Portland Cement Association, 33 W. Grand Ave., Chicago. Copies of the booklet may be obtained without charge, by writing to the association.

Color Chart for Sand Tests

Can you tell me where I may obtain a copy of the color chart for colorimetric tests of sand, to determine the presence of organic impurities?—P. C. I., Providence, R. I.

The standard color chart for colorimetric tests of sand is embodied in the A. S. T. M. Standard C40-33, Method of Test for Organic Impurities in Sands for Concrete. This standard is printed in the 1933 Book of A. S. T. M. Standards; but separate copies of the standard are available at 25 cents each, from the American Society for Testing Materials, 260 South Broad St., Philadelphia.

All A. S. T. M. standards are similarly available in separate form, at the regular price of 25 cents a copy.

Cinders for Cinder Concrete

Have you anything available on specifications for cinders for use in the manufacture of cinder concrete building units?—M. W. S., Jackson, Miss.

An article on page 42 of the July (1930) issue of CONCRETE tells of new specifications adopted by the Underwriters' Laboratories, Inc., for cinders to be used for cinder concrete units acceptable to the Underwriters' Laboratories inspection service. When cinders are so used, the content of combustible material in the cinders shall not exceed 35 per cent, by weight, of the total weight.

It is not usually advisable to use cinders from ordinary boilers such as those used in dwelling houses or apartment houses, for the reason that the burning has not been sufficiently complete. Neither should cinders from locomotive boilers be used, for the reason that they are likely to be coated with soot. Usually cinders obtained from high-temperature boilers in power plants are the most satisfactory. Concrete block manufacturers who make cinder units usually find some such source of supply, and when they have found a source that is reliable, they use cinders only from that source.

Waterproofing Concrete Burial Vaults

We are manufacturing concrete burial vaults, having just recently added this product to our line of manufacture. Although we feel that we are following the best concrete-making methods, our vaults absorb more moisture than they should. Can you suggest some method of procedure that will improve the waterproof quality of our concrete?—N. E. S., Louisville, Ky.

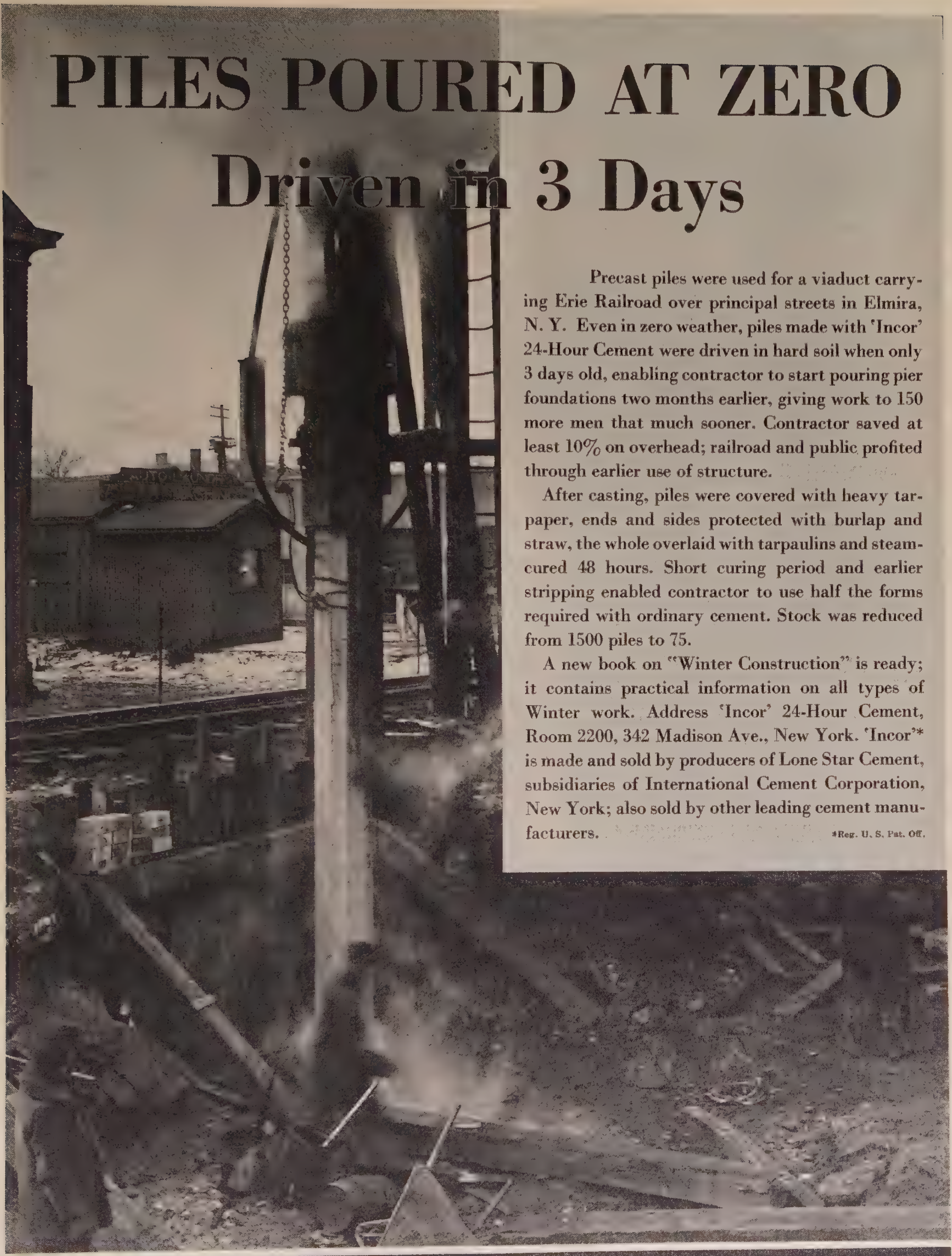
In all probability you could improve the watertightness of your concrete by engaging some concrete technologist to make an anlysis of the aggregates you are employing and giving you recommendations on the proportions that would produce the greatest density.

Another great help in increasing the density (and consequently the watertightness) of concrete is by employing high-frequency vibration in placing the concrete. Reference to advertisements in CONCRETE will disclose the names of several manufacturers of such equipment.

As to exterior waterproofing coatings, we refer you to a proprietary waterproofing finish prepared especially for use with concrete burial vaults. This product has gilsonite as its base and is available either in brown or dark green color. Any additional painting coats may, of coarse, be applied over it.

PILES POURED AT ZERO

Driven in 3 Days



Precast piles were used for a viaduct carrying Erie Railroad over principal streets in Elmira, N. Y. Even in zero weather, piles made with 'Incor' 24-Hour Cement were driven in hard soil when only 3 days old, enabling contractor to start pouring pier foundations two months earlier, giving work to 150 more men that much sooner. Contractor saved at least 10% on overhead; railroad and public profited through earlier use of structure.

After casting, piles were covered with heavy tarpaper, ends and sides protected with burlap and straw, the whole overlaid with tarpaulins and steam-cured 48 hours. Short curing period and earlier stripping enabled contractor to use half the forms required with ordinary cement. Stock was reduced from 1500 piles to 75.

A new book on "Winter Construction" is ready; it contains practical information on all types of Winter work. Address 'Incor' 24-Hour Cement, Room 2200, 342 Madison Ave., New York. 'Incor'* is made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York; also sold by other leading cement manufacturers.

*Reg. U. S. Pat. Off.

'INCOR' 24-Hour Cement

New Books and Pamphlets

Facts for Concrete Contractors

Concrete Facts for Concrete Contractors. Revised edition of a 48-page, 6 by 9-in. illustrated booklet published by the Portland Cement Association, 33 W. Grand Ave., Chicago, Ill., and reviewed on page 34 of the July (1931) issue of Concrete.

The revised edition contains some new material of interest to concrete contractors, notably a complete specification for colored concrete topping. Other sections of the booklet cover subjects such as selection of materials; proportioning, mixing, placing, finishing and curing concrete; colored concrete work and special surface finishes; form work for concrete; reinforced concrete, watertight concrete, high-early-strength concrete, and concrete work in cold weather.

Every contractor who specializes in concrete construction work should have a copy of this booklet, copies of which may be obtained on request.

Joints for Concrete Pavements

Joints for Concrete Pavements is the title of a 48-page paper-covered book by L. J. Mensch, consulting engineer, Chicago, just published by the author.

The author analyzes joints in concrete road slabs from the basis of engineering principles. Stresses are analyzed by considering wheel loads placed in the most unfavorable position, and by regarding parts of slabs adjacent to joints as not being in contact with the subgrade. Individual chapter headings cover (1) a historical review; (2) analysis of stresses in pavements, due to joints; (3) analyses of dowel action; (4) requirements of good joint practice; and (5) the solution of the problem.

Highway engineers interested in the subject may obtain copies without charge, on request addressed to Concrete.

Rigid-Frame Concrete Bridges

Analysis of Rigid-Frame Concrete Bridges.—Third edition, 1934. Published by the Portland Cement Association. Paper cover, 40 pages, 6 by 9 in., illustrated.

This new edition has been enlarged by adding many new features and results of recent studies. In addition to analysis by moment distribution, a new chart and a new formula are given as the basis of a procedure by which moments may be determined quickly without use of frame analysis. This new procedure is valuable for use in making preliminary designs or in checking moments obtained by frame analysis.

Copies of this booklet are available by writing to the Portland Cement Association, 33 West Grand Avenue, Chicago, Illinois.

Skidding and Tractive Resistance

Tractive Resistance as Related to Roadway Surfaces and Skidding Characteristics of Automobile Tires on Roadway Surfaces, published respectively as Bulletin 119 and Bulletin 120 of the engineering experiment station at Iowa State College, at Ames, Iowa, set forth the results of several series of tests conducted on road surfaces of concrete, brick, asphalt, tar, road oil, gravel, cinders, asphalt plank, steel plates and wood plank.

Copies are available for free distribution while the supply lasts.

Coming Conventions

January 31-February 2—**Mississippi Valley Conference of State Highway Departments. 27th Annual. Stevens Hotel, Chicago. M. W. Torkelson, President, Madison, Wisconsin.**

February 7-9—**The Engineering Institute of Canada. 49th Annual. General Meeting. Royal York Hotel, Toronto. R. J. Durley, General Secretary, 2050 Mansfield St., Montreal, Canada.**

February 9—**Kentucky Association of Highway Contractors. Annual. Louisville.**

February 14-16—**National Cinder Concrete Products Association. Eleventh Annual. Hotel Astor, New York City. Einar Christensen, President, 1600 Arch St., Philadelphia, Pa.**

February 16-24—**Chicago Modern Homes Exposition, Inc. Coliseum. H. H. Potts, Manager, 1 N. LaSalle St., Chicago, Ill.**

February 18-19—**National Concrete Masonry Association. Annual. Pennsylvania Hotel, New York City. Horace W. Bush, Sec. and Treas., 211 Edgemont Place, Teaneck, N. J.**

February 19-21—**American Concrete Institute. Thirty-First Annual Convention. Roosevelt Hotel, New York City. Harvey Whipple, Secretary, 7400 Second Blvd., Detroit, Mich.**

February 20-21—**American Concrete Pipe Association. Annual. Edgewater Beach Hotel, Chicago. M. W. Loving, Secy., 33 West Grand Avenue, Chicago, Ill.**

March 6—**American Society for Testing Materials. Regional Meeting, Philadelphia. R. E. Hess, Asst. Secy., 260 South Broad Street, Philadelphia, Pa.**

March 4-8—**American Society for Testing Materials. Group Meetings. R. E. Hess, Asst. Secy., 260 South Broad Street, Philadelphia, Pa.**

March 3-10—**Leipzig Trade Fair, Inc. Spring Trade Fair with Exhibits. Leipzig, Germany. Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.**

April 23-24—**National Concrete Burial Vault Association. Annual. Statler Hotel, Cleveland, Ohio. J. H. Stuart, Secy.-Treas., Bremen, Ohio.**

June 24-28—**American Society for Testing Materials. 38th Annual Meeting and Exhibit of Testing Apparatus and Related Equipment. Book-Cadillac Hotel, Detroit, Michigan. R. E. Hess, Asst. Secy., 260 South Broad Street, Philadelphia, Pa.**

Boulder Dam in Motion Pictures

The interest in Boulder Dam throughout the country has created a surprising demand for motion pictures of the construction operations. In an effort better to meet the many requests for the official Government progression pictures, the handling of them has been turned over to a private enterprise designated the Boulder Dam Film Library. This concern is doing business in Boulder City, Nevada, under a Government permit which binds it to carry a sufficient number of prints of the film to supply the calls that are received. The films, which are available in either 16 mm. or 35 mm. size, cover all phases of the work completed to date. Their 4,000 ft. of length represents the edited version of some 16,000 ft. that has so far been taken. A nominal rental charge is made.

This motion-picture record of the work is being produced under the direction of the Boulder Dam Film Board, which is composed of representatives of the U. S. Bureau of Reclamation, Six Companies, Inc., and the Babcock & Wilcox Company. It is expected that the film will be approximately 8,000 ft. in length by the time the project is completed.—From Vol. 4 of THE STORY OF BOULDER DAM, by Ingersoll-Rand, New York City.

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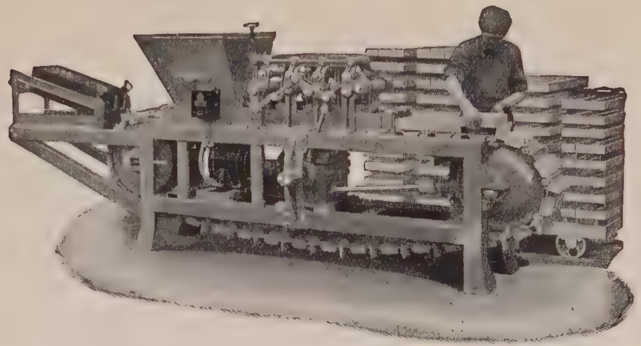
30 more open soon



London's New Dunbrik Plant Installing Thirty More of These Machines

When Arthur F. Echberg and Associates of London, England, started, DUNBRIK was a new product in a new territory. Yet before the first plants were completed his company had orders for more than Ninety Million DUNBRIK and they were shipping by train load. Now in less than three months they are installing thirty more DUNBRIK Machines with an output of more than 450,000 DUNBRIK daily.

Dunbrik Important Factor in England's Building Boom Meets Immediate Favor English Builders

Mr. Echberg is an international figure in construction business, his associates men prominent in English building and financial circles. Before their first order was placed, they had investigated DUNBRIK'S remarkable success in the United States and Canada even during the depression, and were convinced that the possibilities for growth and expansion would be almost unlimited, once DUNBRIK was made available in England's great, new building market.

The immediate favor with which DUNBRIK was met by England's leading Architects, Builders and Municipal Authorities and the tremendous expansion which has taken place has far exceeded their expectations.

The National Housing Act Has Opened the Doors to Equal Opportunity for You

What Mr. Echberg and associates have accomplished in England with DUNBRIK can and will be more than duplicated by DUNBRIK manufacturers in the United States during the next few years.

Our own National Housing Act is bringing about just such concerted action as was responsible for ENGLAND'S GREAT BUILDING BOOM. Finances for building will be available everywhere under this "New Deal" for the Home Builder, and with our far greater potential market DUNBRIK offers you one of today's greatest manufacturing opportunities.

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Now is the time to get set on this outstanding opportunity. The FHA is opening a market in 1935 for over 620,000 new buildings. The qualifications favored for a Twenty Year Insured Mortgage Loan are Beauty, Permanence, Fire Safety and Low Cost. No other unit combines them in so great a degree as DUNBRIK. With it you can offer the home builder all of these essentials at a substantial profit to yourself.

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Learn how DUNBRIK'S superior qualities, plus Automatic Line Production, will enable you to dominate the brick market in your community. Do it now while your territory is still open. Mail coupon today.

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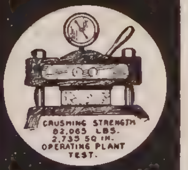
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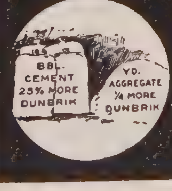

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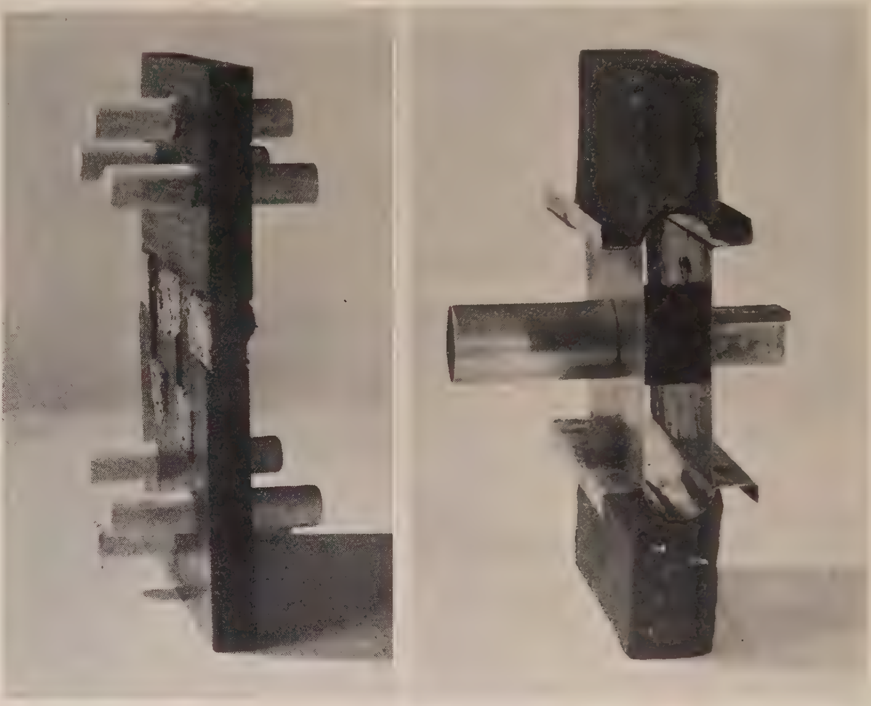
Metal Cushion Joint Resists Heavy Highway Loads

Translode Device Provides Expanding and Contracting Bridging to Transfer Loads Across Joint

A NEW metal cushion joint of standard construction is being introduced by the Servicised Products Corporation. The joint consists of top and bottom seal, comprised of copper or other suitable metal, fastened to a metal casing of standard dimension. The casing has fastened to one of its sides a T-shaped bar, rigidly fastened to one side and passed through the other side into a tubular construction, allowing for expansion and contraction of the sides of the metal cushion joint. Upon compression re-expansion is caused by a rubber gasket placed over the bar, which, upon being compressed, again causes re-expansion upon the release of compression. The cap of the copper metal seal may be composed either of bituminous material, elastic cork material or sponge rubber. Metal cushion joints are prepared in standard lengths and may be alternated with expansion joints of various types, such as an all cork, all sponge rubber or preformed asphalt joint, in conjunction with a novel translode device, which is placed between the expansion joints and acts as an expanding and contracting bridging device for the concrete slabs.

The device consists of two ½-in. steel plates, having dowels extending transversely in either piece, which are embedded in the concrete to hold the plates thoroughly and in alignment with the plate directly opposite. Extensions are provided which are mounted and work in conjunction with opposite extensions, which in turn are held in position by sponge rubber pads, preventing the concrete mass entering in between the spaces provided for motion due to expansion and contraction in the slab. These pads consist of 1-in. material. They hold the spaces 1 in. apart and alternately allow them to extend inwardly 1 in. from the edge of the plate, so that the slabs are always interlocked. The expansion and contraction are provided for by the sponge rubber pads, which allow this sliding motion to extend inwardly approximately 1 in., and upon contraction these extensions again pull apart, but are interlocked about the space of an inch.

These translode expansion and contraction plates are said to prevent lateral motion in the slab and vertical disalignment, yet do not interfere with the expansion and contraction of the slab. When a heavy load strikes the slab the shock is taken up by the expansion and contraction extensions without in any way permitting a dipping motion of the slab, which is the case in most instances where the load is transferred from one slab to another. There can be no enlargement of the space below the slabs where the expansion joints occur, and with the proper installation they should act as a bridging device at the point where expansion and contraction are taken care of.


(Left): Translode expansion plates. (Right): Air cushion metal expansion joint

It is claimed that this type of construction, whether an elastic or metal cushion joint is employed, will preserve the relationship and alignment of the slab and prevent cracking due to strains by load impacts.

It is claimed that the Servicised translode expansion plates will prevent much cracking and preserve the expansion joint's alignment to better advantage than the present systems of dowel bars and translode contrivances. The manufacturer declares that upon the growth of the concrete slabs, which in the course of four or five years on a ½-in. joint causes the slabs to be in almost an abutting relation, the plates will still function even if the opening is reduced to ¼ in. between the extension fingers, so that the bridging means will continue to function even though the concrete slabs have finally abutted and the ratio of expansion and contraction consequently is reduced to a minimum.

Patents have been applied for and the manufacturer believes that the translode expansion plates will overcome many of the difficulties which have been encountered at the expansion joint and wherever concrete slabs are placed in abutting relation.

Cost of Mud-Jack Operations

WHAT is the cost of raising warped or settled concrete road slabs and street pavements by means of a compressed air-driven force pump known as the mud-jack?

CONCRETE has been fortunate in obtaining detailed cost data from several large states where this form of maintenance work has been carried forward on an extensive scale. Settlements of fills over swampy soil have resulted in settlement or warping of the concrete slabs resting on them. Similar trouble sometimes develops on fills at bridge approaches. The mud-pump, by forcing cement-tempered mud through holes drilled into the slabs, has corrected the trouble.

Highway engineers will be interested in these articles, the first of which is to appear in the March issue of CONCRETE.

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We will send you our new well illustrated booklet "Burial Vault Molds and Vault Makers' Supplies." It includes a discussion of concrete as a material for burial vaults, use of adjustable molds, manufacturing operations and costs of manufacture, needed accessories, merchandising plans and stories of men who have made money from the "Automatic Sealing Vault."

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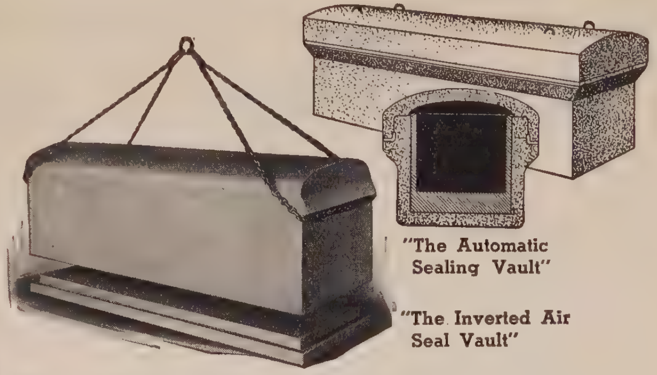

"The Automatic Sealing Vault"

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BASIC PRINCIPLES of Concrete Making

By FRANKLIN R. McMILLAN
Director of Research, Portland Cement Association

THE author has culled the essentials out of a mass of scientific data on this subject and presents them with force and directness in this book. He shows the effects of quality of material, of proportioning, mixing, working and curing on the finished concrete.

The importance of variable mixes; tests for permeability; how to obtain strength, durability and watertightness; effective ratios; importance of proper construction methods—these and many other vital topics are discussed fully and authoritatively.

The book represents not only extensive accumulated knowledge, but also wide practical experience in the field and laboratory. It is an enlargement and revision of a series of notable articles on concrete mixing by Mr. McMillan published in 1929.

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A. G. C. in Convention at Washington

WITH Secretary of Commerce Daniel C. Roper and other high government officials addressing its sessions, the sixteenth annual convention of the Associated General Contractors of America is under way at the Willard Hotel, in Washington.

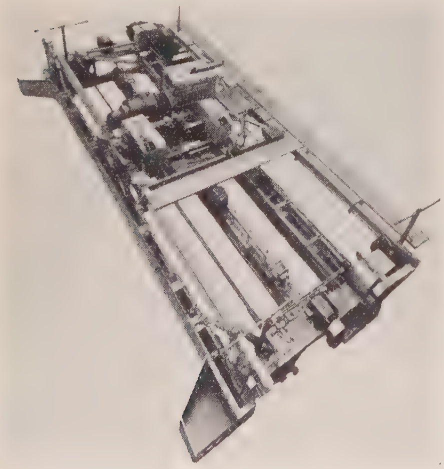
The opening session of the convention, held on January 28, was devoted largely to consideration of President Roosevelt's $4,000,000,000 work-relief program and its potential effect upon the construction industry.

The proposed national economic security plans also came in for careful study by the contractors, and were the subject of an address by Dr. Edwin E. Witte, executive director of the President's committee on economic security. Willard T. Chevalier, of the McGraw-Hill Publishing Co., New York, spoke on "The Construction Industry of Tomorrow."

Speakers at the second day's session included Dr. Elwood Mead, U. S. Commissioner of Reclamation; Thomas H. MacDonald, chief of the United States Bureau of Public Roads; H. O. Schermerhorn, of the New York State Department of Public Works; and J. O. Gholston, chief engineer of the PWA Inspection Division. The closing sessions on January 30 were addressed by Major-General Edward M. Markham, chief of the Army Corps of Engineers; A. P. Greensfelder, of St. Louis, vice-chairman of the Construction League of the United States; and A. E. Horst, of Philadelphia, chairman of the Divisional Code Authority for General Contractors.

EQUIPMENT AND MATERIALS

THE Blaw-Knox gas-electric road finisher, the makers say, is supported entirely on the surface of the concrete slab and does not touch the side forms. The complete vibration unit is spring-suspended from the finishing machine. Vibration is not transmitted into the machine, all the vibration being absorbed by the concrete. The frequency and amplitude of vibration is adjustable over a wide range to suit varying concrete mixes. The Blaw-Knox Company, Pittsburgh, says that the vibrator attachment consists of two independent 10-ft. units, each operated with an independent motor drive. Each of the vibrators is equipped with two vibrating elements making a total of four. All controls are located at the center of the machine for the convenience of the operator.



Blaw-Knox gas-electric road finisher of 20-ft. width equipped with a surface vibrator for concrete pavement construction

The front screed, they say, is arranged for striking off the concrete at a variable adjustable height above the top of the side forms in order to provide the required excess of concrete to be compacted by vibration.

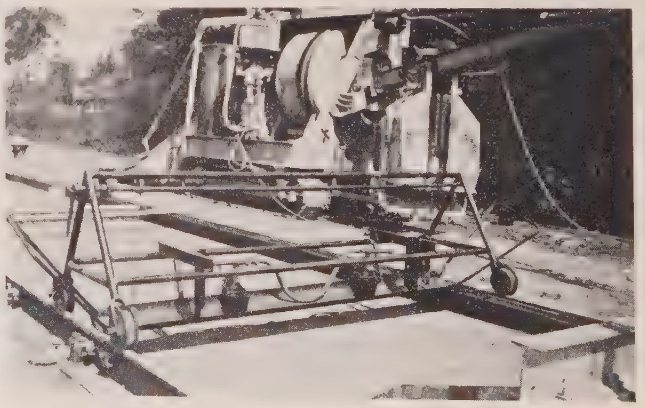
With the first trip, the concrete is struck off with the front screed and simultaneously vibrated down to the level of the top of the form.. The pavement is then double-screeded in the conventional manner.

One operator controls the entire vibrating and finishing process with no delay to production, they say.

The surface vibrator attachment is furnished in any width required, and to operate below the top of the side forms where necessary.

●

THE vibrating screed board mounted in a carrier frame is a further development, by Munsell Concrete Vibrators, Jersey City, N. J., of the use of vibration for placing concrete highway pavement where specifications require the application of vibration entirely free from the forms. The screed board is allowed to move vertically, freely, and, if so desired, to place the concrete in two or more courses, they say.



Mounted vibrating screed board used in placing highway pavement

Manufacturers' News

UNIVERSAL Form Clamp Co., Chicago, has opened offices and factory at 130 Hooper Street, San Francisco. From this location they will manufacture and distribute their products to the entire Pacific Coast.

Production facilities will include reinforcing accessories, Uni-Form panel forms and the company's general line of construction products.

The Pacific Coast division will be under the direction of MacGregor S. Anderson.

●

MASONITE Tempered Presdwood (1935) is the title of a new 16-page book of specifications and details, published by the Masonite Corporation, Chicago; covering, they say, the greater number of Masonite Tempered Presdwood concrete form board installations.

The face surface of Masonite Tempered Presdwood is smooth and semi-polished—grainless and knotless—and the back is a screen-mesh indented surface. Thickness: $\frac{3}{16}$-, $\frac{1}{4}$-, and $\frac{5}{16}$-in.

Vol. XLIII
No. 2

Cement Mill Section of
Concrete

FEBRUARY
1935

Box Cars Become Gravity-Unloading Bulk Cement Carriers

Delaware & Hudson Adds Thirty Cars to Bulk Cement Equipment—How Box Cars Are Altered—Cement Industry Needs More of This Equipment

THE Delaware & Hudson Railroad is the latest of the railway systems to provide special rolling stock for the convenient shipment of portland cement in bulk.

As in some other cases, the cars were not built new, but were converted from other uses by making certain alterations to existing equipment.

Change from Coal to Cement

For example, in 1933 about 20 of the Delaware & Hudson's all-steel twin hopper coal cars were converted into carriers of bulk cement. Alterations to these coal cars included (1) the construction of steel roofs which, in turn, were provided with eight rectangular hatches for convenient loading of the cars; (2) installation of four special unloading hoppers fitted with gates; (3) construction of transverse bulkheads at the car's mid-length, to divide the load; and (4) alteration of the slope sheets to provide a steeper pitch.

Converted Box Cars Haul Bulk Cement

In 1934, however, the railway company developed the novel plan of converting ordinary box cars into carriers of bulk cement. One of the cars is shown in the illustrations on this page (Figures 1 and 2). It was felt that box cars could easily be spared from their former service, and it was known that the cost of the alterations would be less than the cost of altering coal cars. A further point of interest lies in the fact that the conversion of the box cars was accomplished in a manner that will readily permit removal of the alterations and the return of the cars to their original type of service.

The railway company altered 30 box cars in this manner in 1934, and added them to the service of shipping bulk cement from cement manufacturing plants on the company's lines at Howe's Cave and Glens Falls, N. Y. Careful estimates indicated that the box cars could be converted at less cost than was experienced in 1933 with the coal cars.

How Box Cars Were Altered

Box cars selected for this service were of steel frame construction, and were rated at 100,000 lb. capacity. Each car had its entire floor removed, after which four hoppers fitted with unloading gates were installed. A close-up of these hoppers is shown in Figure 2. Wooden slopes were then built toward each end of the car, roughly halfway between the ends and the midpoint of the car, and extending from the hoppers to the roof. A transverse bulkhead was installed at the center of the car for the purpose of

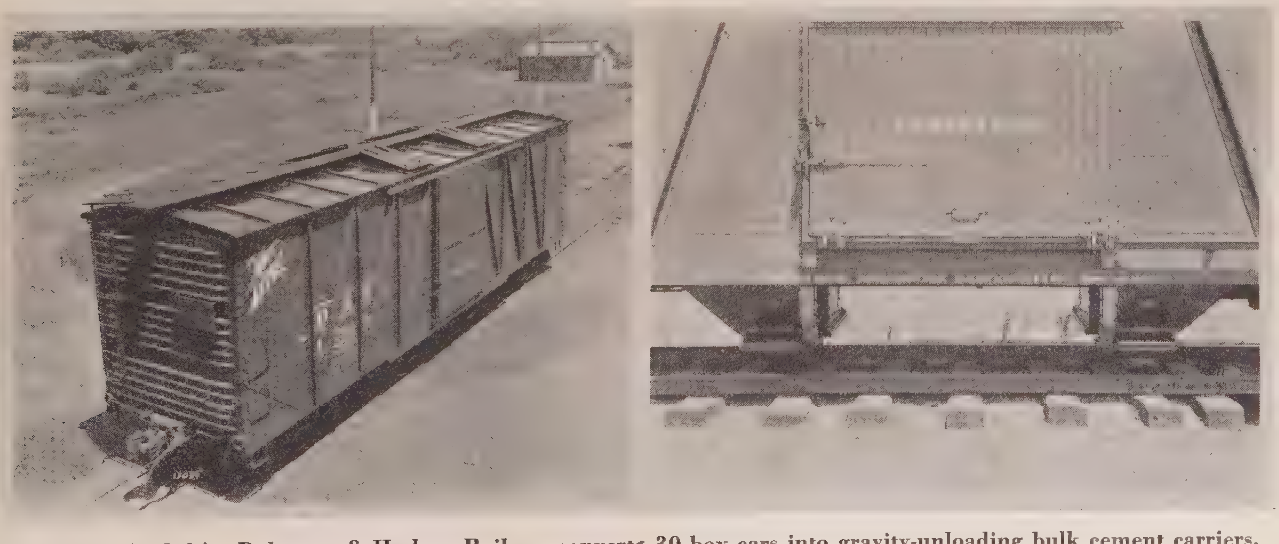


Figure 1 (at left). Delaware & Hudson Railway converts 30 box cars into gravity-unloading bulk cement carriers. This view shows loading hatches in roof. Figure 2 (at right). Close view of hopper outlets and gates dividing the load and permitting the shipment of two different brands or products in the same car. This bulkhead extends from the short hopper slopes to the roof. Four loading hatches were built into the roof, to permit proper spreading of the load. The side doors of the box cars were fastened in the closed position, and the doorways were closed up with paneling. The entire interior was then covered with galvanized iron, to aid the flow of cement.

As was previously emphasized, all the slopes, the bulkhead and the doorway fillers were built in sections, to permit their easy removal if it becomes desirable to return these cars to regular box-car service.

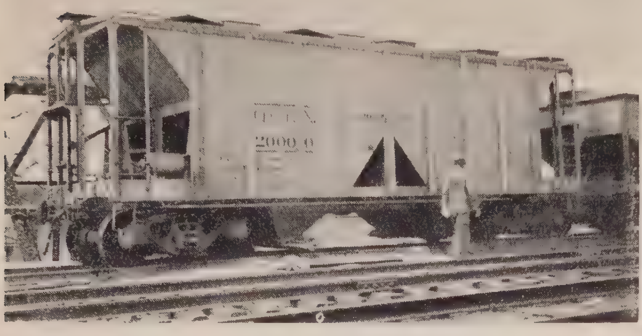


Figure 3. American Car and Foundry's gravity-unloading hopper car transporting bulk cement to Mississippi River dam

These new bulk-cement carriers have given excellent service, satisfactory alike to the railway company and to the shippers and consignees. The Delaware & Hudson officials have received a number of inquiries from officials of other railroads.

Some Other Railroads Have Similar Carriers

Other railway companies that have placed a limited number of cars into this service include the Lehigh Valley, the Pennsylvania, the Baltimore & Ohio, the Jersey Central, the Lehigh & New England, the Reading, and the Delaware, Lackawanna & Western. In their construction the bulk-cement cars put into service by these roads are quite similar to the converted coal hopper cars altered by the Delaware & Hudson in 1933. They differ in minor details only. The Delaware & Hudson, however, has been the first to see the possibilities in box cars.

The Lehigh Valley Railway Company's bulk-cement cars are described in an illustrated article in the July (1932) *Cement Mill Edition* of CONCRETE.

Equipment Manufacturers Take Action

Manufacturers of railway equipment, likewise, have given considerable thought to the development of railway cars suitable for bulk shipment of all kinds of granular and pulverized commodities, including portland cement.

One instance is the self-unloading railway tank car developed by the General American Tank Car Corporation and the Link-Belt Company, and described in detail in an illustrated article in the May (1932) *Cement Mill Edition* of CONCRETE. In its outward appearance that car is quite similar to the ordinary tank car employed in transporting liquids. The interior of this car is divided into three compartments—two large compartments containing the material and a small compartment at the center of the car which houses the machinery by which it is unloaded. The unloading mechanism is simple, consisting of power-driven drag chain conveyors which are pulled along toward the center outlet by sprockets located in the center compartment.

Several More Gravity-Unloading Types

About two years ago the Union Railway Equipment Company's new bulk-cement gravity-unloading hopper car was brought to the attention of the cement industry by the *Cement Mill Edition* of CONCRETE, in an illustrated article in the issue of April, 1933. Special features of that car are found in the fact that during the loading operations the roof can be opened by a hand wheel, on either side or both sides; and ventilation is provided when the roof is closed, thereby preventing too high a temperature within the car.

The American Car and Foundry Company also has developed a gravity-unloading hopper car for the shipment of cement and similar commodities in bulk.

Steep Slopes in Hopper Bottoms

One of these cars is shown in Figure 3, transporting bulk cement from a plant in Illinois to one of the federal government's dams under construction in the Mississippi River. A close-up of the hopper doors, equipped with tightly fitting gates, is shown in Figure 4.

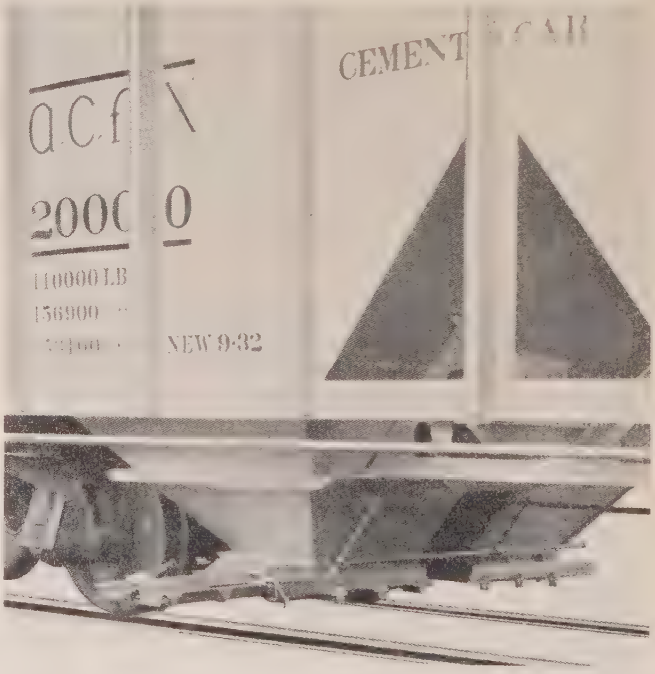


Figure 4. Close view of hopper outlets of car shown in Figure 3

Reference to Figures 3 and 4 discloses that in its general appearance this car is similar to the converted coal cars put into service as railway-owned equipment by some of the eastern railroads. The methods of loading and unloading also are similar; but it will also be seen that in the American Car and Foundry Company's equipment the car body is higher and the slopes of the hopper bottoms are much steeper than is the case with coal cars. This feature, of course, facilitates the flow of the cement dur-

(*Continued on page* 46)

Electro-Filter Makes Rapid Advance in European Industry

Dust Collection in Cement Industry One of Important Uses—Construction of Electro-Filters and Their Fundamental Principles Described

By R. HEINRICH
Consulting Engineer, Berlin, Germany

(*Translated from the German by A. W. King, Chicago, Ill.*)

SYNOPSIS.—*The paper, translated from Elektrotechnische Zeitschrift, 55* (1934), No. 17, 413-417, *describes the construction of electro-filters and devotes particular attention to the ionization and migration velocities of the dust as a function of the particle diameter, together with calculations of filter operation. The use of electro-filters in smelters, steel mills, in the chemical industry, for the purification of producer gas, in the cement, the lignite, and the coal industries, and for the purification of flue gases is discussed one by one.*

THE development of smoke and dust is unavoidable in most of the important branches of industry (Table 1), and thus efforts have already been made for many decades to avoid the losses of capital and the nuisances caused by dust and smoke, by resorting to all kinds of arrangements for the removal of dust. Mention may be made, for example, of dust chambers sometimes over 1,000 meters long, that were used years ago in smelters for settling the dust, the cyclones or layer filter, which took the form of large containers filled with coke, the cloth filters and the wet washers.

To these devices for dust removal, there has been added in the last decade the electro-filter, which has found widespread use in the most important branches of industry in a relatively short time because of its many different advantages. The outstanding advantages of the electro-filter may be named in the following order:

1. Slight loss in draft of about 2 to 5 mm. water column.
2. Low power consumption of approximately 0.05 to 0.5 kw.-hr. per 1,000 cu. meters of gas.
3. Applicability to temperatures up to about 400 to 500 deg. C.
4. Low depreciation and low labor operating cost.
5. Remarkable freedom from break-downs and a high efficiency in the removal of dust, 98 per cent and higher.

Principles of Electro-Filters

The fundamental principle on which electro-filters are built is quite simple. A distinction is made between tube filters, flat shaft and chamber filters. Common to all of these are the electrodes causing precipitation, which consist of sheet metal tubes having a diameter of about 300 mm. and a length of from 3 to 5 meters, made of plain or corrugated sheet metal or composed of narrow sheet metal chambers that are fitted with collecting pockets; besides, there are the electrodes from which the current flows out, or the scintillating electrodes, which are made of thin wires, chains, bands, or bars of rolled steel having all kinds of shapes. The electrodes causing precipitation are connected with the positive pole of some source of high tension, continuous current, which source, like the metallic parts of the structure in which the source is housed, is grounded so that they can be touched without any danger. The emitting electrodes are placed in the axes of the precipitating tubes, or in the middle between the precipitating plates which run parallel to the current of gas and are separated by a distance varying from 200 to 300 mm. and connected with the negative pole of the

TABLE 1. DUST PRODUCTION AND DUST LOSSES IN VARIOUS INDUSTRIES

Dust, Smoke or Fog Production in Waste Gases	At Operating Temperature Grams per cu. meter	Dust or Fog Production, Based on the finished product, Per cent by weight
1. *Smelting Industry:*		
(a) Iron blast furnaces, measured before gas reaches dust collectors	10 to 40	4 to 16
(b) Lead and tin shaft and reverberatory furnaces	3 to 20	3 to 12
(c) Converters for refining copper	6 to 10	3 to 6
(d) Brass melting furnaces	1 to 5	2 to 4
2. *Chemical Industry:*		
(a) Sulfide roasting furnaces	2.5 to 5	3 to 6 of sulphide processed.
(b) Blende roasting furnaces	5 to 15	6 to 15 of blende processed.
(c) Sulfuric acid fog; concentration waste gases	4 to 10	0.5 to 1.5
3. *Gas Industry*		
(a) Lignite gas producers; dust	5 to 50	2.5 to 25
(b) Lignite still-type producers; tar and oil	20 to 35	4 to 6
4. *Cement Industry:*		
(a) Rotary kilns, wet process	5 to 10	6 to 10
(b) Rotary kilns, dry process	8 to 20	8 to 20
(c) Raw material dryers	20 to 80	8 to 25
(d) Cement mills and dust removal from screw conveyors	20 to 50	3 to 6
5. *Drying Industry:*		
(a) Alumina dryers and calcining plants	30 to 100	10 to 25
(b) Potash salt dryers	5 to 20	3 to 8
(c) Lime, gypsum and sand dryers	5 to 50	4 to 20
6. *Coal Industry:*		
(a) Tube dryers for lignite	12 to 25	6 to 12
(b) Coal dryers	10 to 20	3 to 5
(c) Screw conveyors, interior dust removal, and grinders	20 to 50	2 to 3
7. *Power Plants and Furnaces:*		
(a) Combustion of pulverized coal	5 to 15	4 to 8
(b) Coal burned on grates	1.5 to 5	2 to 5
(c) Combustion of raw unconsolidated lignite	1.5 to 3	2 to 4
(d) Incinerator plants (the burning of refuse)	3 to 10	2 to 5

high tension source. With this hook-up, as experience has shown, there is secured the maximum potential between the electrodes and so the optimum filter efficiency. The velocity of the gas between the electrodes varies from 0.5 to 5 meters per second, depending upon the conditions prevailing.

The high tension continuous current required for operating electro-filters is in most cases produced by mechanically operated high tension synchronous rectifiers (motor generator sets); in some cases also cathode ray, and Wehnelt valve-tube rectifiers. Copper oxide plate rectifiers have also been used, but they are appreciably more expensive than the other kinds of rectifiers. The wiring diagram of a mechanical rectifier is given in Figure 1. Instead of the mechanical mono-phase rectifier, mechanical triphase alternating current (rotating current) rectifiers delivering a continuous current with a very slight waviness has been frequently used during the past few years. The operating voltage between the electrodes of the electro-filter varies from about 40,000 to 70,000 volts. With the smaller filters the current strength is approximately 5 to 10 milli-amperes; with very large installations the current ranges between 200 and 500 milli-amperes.

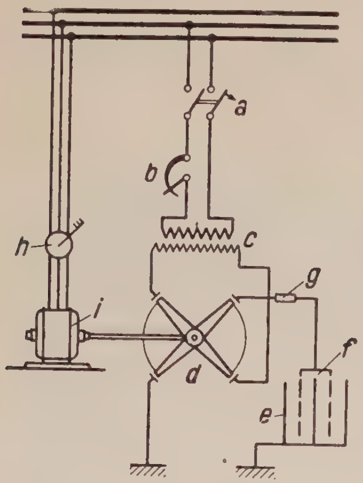


Figure 1. Rectifier connections. a, main switch; b, voltage regulator; c, transformer; d, rectifier; e, precipitating electrode; f, scintillating electrodes; g, choke coil resistance; h, starting switch; i, synchronous motor

Reactions at Electrodes

The following reactions take place in the space about the electrodes. In the immediate vicinity of the thin, emitting wire, as a result of the intensely powerful electrical field, there is formed the well-known, bluish, softly hissing, corona discharge. The gas is ionized. Large quantities of positive and negative ions are formed. The positive ions immediately migrate to the scintillating, negative wire, and are there relieved of their charge. The negative ions, on the other hand, fill the entire space about the electrode as a charge in space, and under the influence of the intensely strong field, move with great velocity to the precipitating electrode. In the meantime, as a result of their thermal movement, and under the influence of the intensely strong field, these ions impart a negative charge to the dust particles floating about in the gas.

The average velocity of the gas ions in the direction of the field is very high, as will be seen in Table 2, which lists these values for several gases. In air, in a field strength of 3,000 volts per cm., the migration velocity of the ions amounts to about 65 meters, per second, whereas with hydrogen under the same conditions, the velocity increases up to about 250 meters per second.

The dust particles charged by the ions likewise migrate to the precipitating electrode under the influence of the electrical field, and there they are deposited in thick layers until they either fall off of their own accord or through the action of a shaking device, and are collected in a dust bin located underneath.

TABLE 2. VELOCITY OF NEGATIVE IONS OF VARIOUS GASES IN AN ELECTRICAL FIELD OF 3,000 VOLTS PER CENTIMETER, IN METERS PER SECOND

Kind of Gas	Formula	Meters per second
Sulfur dioxide	SO_2	12.3
Water vapor	H_2O	21.9
Ammonia	NH_3	24.0
Carbon dioxide	CO_2	30.3
Oxygen	O_2	54.6
Nitrogen	N_2	55.2
Air	....	65.4
Hydrogen	H_2	248

The Precipitated Dust

If the precipitated dust conducts electricity well enough, its charge immediately flows off to the grounded, precipitating electrode. However, it sometimes happens that the dust is a very poor conductor of electricity, so that the charge on the dust cannot flow off to the precipitating electrode. Then there is formed a strong surface charge on the dust, which is so powerfully built up by the gas ions which are continuously formed anew, that field strengths of 20 to 30 kilo-volts per cm. occur between the dust surfaces on the precipitating electrode and the electrode itself. The results of this action are powerful ionization phenomena in the dust layer, and the formation of positive bunches of electrical scintillation which are plainly shown on the left-hand side of Figure 2. On the right-hand side of the illustration can be seen negative scintillating nuclei on an emitting wire, that is placed at a distance of about 150 mm. from the precipitating surface and parallel to it. The precipitating electrode in this case acts like a positive emitting electrode; the arcing voltage is reduced by about 20 to 30 per cent. Arcs occur between the electrodes, and the efficiency of the filter is reduced. Under dust conditions of this kind, it is possible, for example, to increase the electrical conductivity of the dust to such an extent by augmenting the relative humidity of the gas, that the surface charges can flow off and so bring about normal and favorable conditions again.

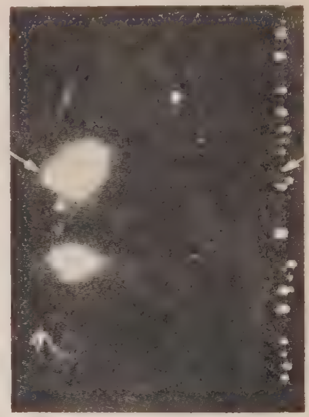


Figure 2. Ionization phenomena in dust layer. At left, positive bunches of electrical scintillation. At right, negative scintillating nuclei on an emitting wire

Under normal filter operating conditions, as shown in Figure 3 a, very high uni-polar charges on the dust are attained, and this also causes high migration velocities.

As is shown in the illustration, dust particles having a diameter of about 1 mu, take on an elementary charge of approximately 10^2 elementary charges in the scintillating field of an electro-filter having an average field strength of about 3,000 volts per cm.

Particles of Larger Size

Up to dust sizes of 1 mu diameter, the charge increases approximately directly proportional to the radius of the little particles. With particles having a larger diameter, on the other hand, the limiting charge increases proportionally to the square of the radius of the particles, so that dust grains having a diameter of 10 mu already take up about 10^4 elementary charges.

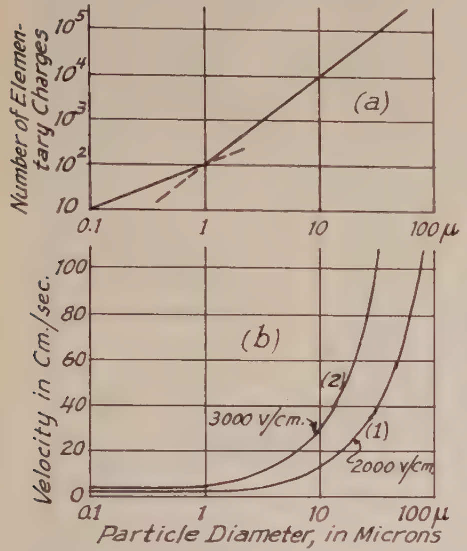


Figure 3. Charge Migration Velocity of Various Sizes of Dust Particles in the Electrical Scintillating Field. Upper chart (a) shows charge on various sizes of particles in an atmosphere containing 10^7 to 10^8 ions per cu. cm. in an electrical field of 3,000 volts per cm. Lower chart (b) shows migration velocity of various sizes of particles, carrying their limit charge in an electrical field of (1) 2,000 volts per cm. and (2) 3,000 volts per cm.

Corresponding to their higher charge, these large particles migrate more quickly in the electrical field and can be separated better in the electro-filter than the smaller ones which carry lower charges. These relationships are clearly shown in Figure 3, in which is depicted the functional relationship between the migration velocity, together with the limit charge of dust particles ranging in diameter from 0.1 to 100 mu, and the field strength in the electro-filter. The limit charge itself is reached in about 0.1 to 0.2 of a second. The measured values agree very well with values calculated on the basis of theoretical considerations.

On the basis of these conditions, with a given dust particle size, and with a knowledge of the conditions prevailing in the filter, such as temperature and viscosity of the gas, etc., the extent of dust removal, for example, in a filter with plate electrodes, can be calculated in advance in accordance with the following equation:

$$N \text{ equals } 1\text{-}e^{-w\frac{L}{vS}}$$

In this equation N indicates the extent of dust removal; w the migration velocity of the dust particles; L the length of the electrodes; v the gas velocity; S the voltage difference between the brush discharge and the precipitating electrodes. This exponential equation simply expresses that for each unit length of the precipitator electrode, there will be deposited the same percentage quantity of the dust still remaining in the gas. This precipitation equation is easily derived from the assumptions that the instantaneous concentration of particles in every cross-sectional area of the filter must be uniform as a result of the gas turbulence which is still augmented by the electrical draft.

Increasing Use of Electro-Filters

As has already been explained, the migration velocity of the dust in the electro-filter very largely depends upon its grain size and upon the field strength in the filter. The finer the dust, the more difficult it is to separate it. A survey of the most commonly occurring grain sizes in various kinds of commercial dusts is given in Table 3:

TABLE 3. APPROXIMATE GRAIN DIAMETERS IN MILLIMETER, OF VARIOUS KINDS OF DUST

Kind of Dust	Diameter in millimeter
Fly ash given by unconsolidated lignite	0.20 to 0.04
Unconsolidated lignite dust	0.20 to 0.04
Cement	0.10 to 0.005
Fly ash given by coal	0.07 to 0.005
Unconsolidated lignite, removal of dust from the inside of buildings	0.06 to 0.001
Dust from the throat of blast furnaces	0.05 to 0.001
Zinc oxide	0.03 to 0.0005
Residual fog from sulfuric acid	0.02 to 0.001
Ammonium chloride	0.05 to 0.0005
Oil fog	0.001 to 0.00006
Soot from the combustion of oil	0.001 to 0.00001
Tobacco smoke	0.0005 to 0.00001

Unconsolidated lignite fly ash with an approximate diameter of 200 to 40 mu is relatively coarse grained and therefore is easily removed. Dust from the throat of blast furnaces or zinc oxide, with diameters of 30 to 0.5 mu, or even soot coming from the combustion of oil with an approximate diameter of 0.1 mu are essentially finer and thus more difficult to remove.

All these kinds of dust are removed with the best results in electro-filters, which, thanks to their many advantages, have been introduced at a steadily increasing rate in a short time in the most important branches of industry.

Metallurgical Plants.—Electro-filters have attained great importance in smelters. Here, in the treatment of silver, copper, lead, tin or zinc ores, there occur fume and dust losses amounting to from 3 to 12 per cent of the finished product. Since the metal-bearing dust collected by the electro-filters is very valuable, they pay for themselves completely at the end of the first year's operation.

Iron Smelting Plants.—Electro-filters have proved equally valuable in the iron smelting industry for dust removal in blast furnace gases containing carbon monoxide. The dust content of the raw gas is from 5 to 10 grams per cubic meter under standard conditions (normal temperature and pressure). After the treatment in the electro-filter, the cleaned gas now contains only about 0.01 to 0.02 grams per cubic meter, normal temperature and pressure. The hot stoves, boilers and gas engines of the plant are then operated with this high-grade clean gas.

Chemical Industry.—The electro-filter has found further extensive applications in the chemical industry for dust removal in hot (500 deg. C.) waste gases bearing SO_2 and coming from sulfide or blende roasting furnaces, for the removal of sulfuric acid fog, from the residual gases of the acid concentrating units, and for the complete removal of arsene from the SO_2 gases coming from the roasting of sulfides. The SO_2 is then used for the manufacture of sulfuric acid by the contact process.

The Purification of Producer Gas.—For the removal of tar and oil from producer, illuminating and carburetted water-gas, the electro-filter has also given good results. With the small consumption of energy, amounting to only 0.8 to 1.0 kw.-hr. per 1,000 cubic meters, and the extraordinarily low operating costs, these gases are more thoroughly cleaned by the electric method than was possible ever to accomplish mechanically.

Cement Industry, Pigments and Salts.—Furthermore, a gratifying field for the application of the electro-filter is the cement industry. There occur here, especially in the raw material dryers, and in the rotary cement kilns, dust losses amounting to 25 per cent of the finished product. Moreover, there is the question of dust removal in the coal dryers, cement mills and the conveyor installations. Similar conditions exist in the mineral pigment and salt industries.

Coal Industry.—One of the most important fields for the application of the electro-filter should indeed be the coal industry. In the drying of the raw unconsolidated lignite, in the briquetting plants, there occur dust losses, amounting to from 12 to 15 per cent. These quantities of dust, that represent a value of many millions of marks annually, are practically completely recovered by means of the electro-filter that operates with a dust removal efficiency of 98 to 99 per cent. In the same way, the electro-filters are used in the coal industry, in the concentration plants of collieries, and in briquetting factories as well as in coal dryers for power plants that have to dry their coal for the combustion of powdered coal.

The Removal of Dust from Flue Gas

Since fly ash, and particularly fly ash from boiler plants fired with powdered coal, often is the cause of disagreeable nuisances, electro-filters are being used in this field with increasing frequency to purify flue gases. In these plants it is often a question of removing dust from several hundred thousand cubic meters in one single installation. Taking into consideration the restricted area generally allotted to such plants, it is necessary to operate these filters with high gas velocities amounting to several meters per second. Since with the use of smooth sheet metal for precipitating electrodes, the dust was again carried away by the flow of gas, it required a great deal of research until a satisfactory solution to this problem was found. At first, tests were made with catch-pocket electrodes as shown in Figure 4, constructed out of corrugated sheet metal with catch troughs. The dust was supposed to enter the catch troughs, and once there, protected from the draft to drop into the dust bins. This the dust did only to a very limited extent.

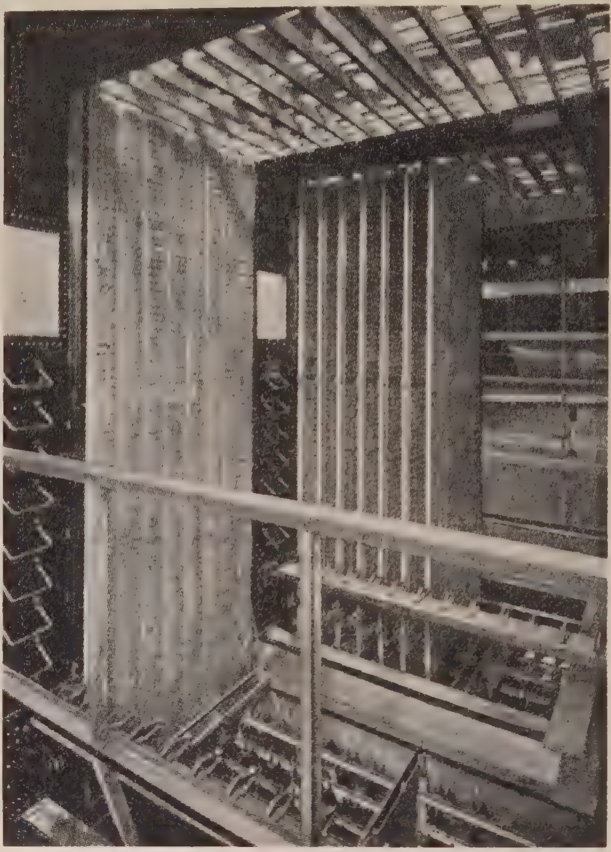


Figure 6. Flue gas electro-filter for 360,000 cubic meters per hr. with high-duty precipitating electrodes in course of erection

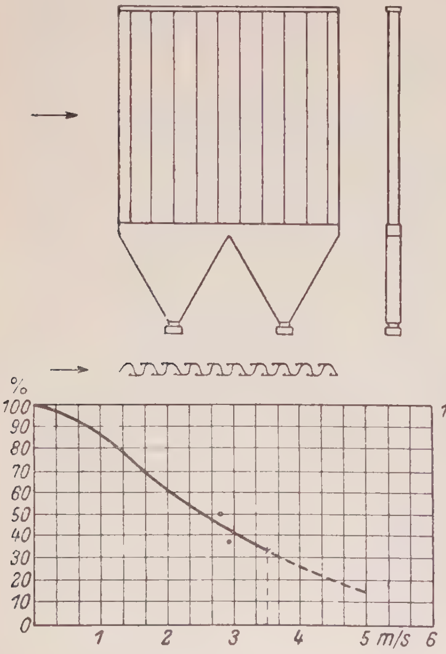


Figure 4 (Left). Extent of dust removal by a corrugated sheet metal, pocket receiver precipitating electrode plotted against the velocity of the gas

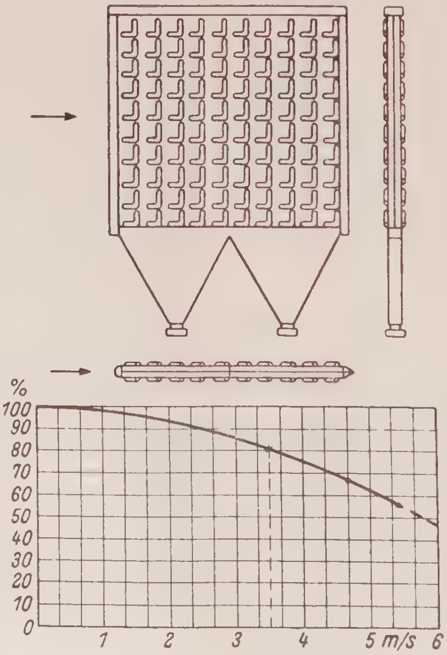


Figure 5 (Right). Extent of dust removal by a pocket receiver, high duty, precipitating electrode plotted against the velocity of the gas

After thorough investigation, there was then developed a box-shaped, high-duty electrode fitted with catch pockets, as illustrated in Figure 5. This electrode gave surprisingly good results. With a gas velocity, for example, of 3.5 meters per sec. with an electrode length of only 1 meter there could be attained a dust removal efficiency of 81 per cent, whereas the first electrode under the same conditions had given only 32 per cent efficiency. The excellent efficiency of the new high-duty, catch-pocket electrode was secured by giving the electrode surface a corrugated form which was constructed of sheet metal having corrugations of predetermined length and height (German patent, 449,644). The following observation led to the corrugation dimensions adopted: If flue gas having the same velocity as that prevailing in the filter, is allowed to flow over a horizontal surface covered with fly ash, then there are soon formed well-defined dust dunes. Constructing the catch-pocket surfaces with these dimensions, then gave, as detailed tests showed, the best separation coefficients. Apparently, there then occur here rhythmic current flow phenomena, as they can frequently be observed on the boundary surfaces of two media which are favorable for the catching of dust, by means of catch pockets. Once that the dust is separated, it then falls into the hollow electrode where it is protected from the current of gas, and then into the dust bin. Figure 6 shows a large flue gas filter chamber with this kind of high-duty electrodes in the process of erection. Such installations were built up to a unit capacity of roughly 1,000,000 cubic meters of flue gas; the clear height of the filter chamber of these units was approximately 9 meters.

High-Efficiency Filters Recommended

The fine residual dust produces a strongly colored smoke cloud issuing from the chimney. In order to prevent this and dust nuisances, it is recommended to choose in flue gas filters of this kind, dust removal efficiencies that are at least 90 per cent; and higher ones are still better.

Attempts have often been made to attain dust removal efficiencies of this nature with mechanical fly ash collectors, but up until now in vain, because separators of this kind, as shown in Figure 7, which is based on carefully obtained data, are partially effective in separating only the coarser dust particles having an approximate diameter of 60 mu and larger. On the other hand, the electro-filter also separates dust particles that are much finer, having a diameter of 10 to 40 mu, to the extent of 90 and 98 per cent and over. The significance of this is shown if one takes into consideration that in the case of plants burning powdered coal it is precisely this fine dust that amounts to 80 per cent, by weight, of the total quantity of dust.

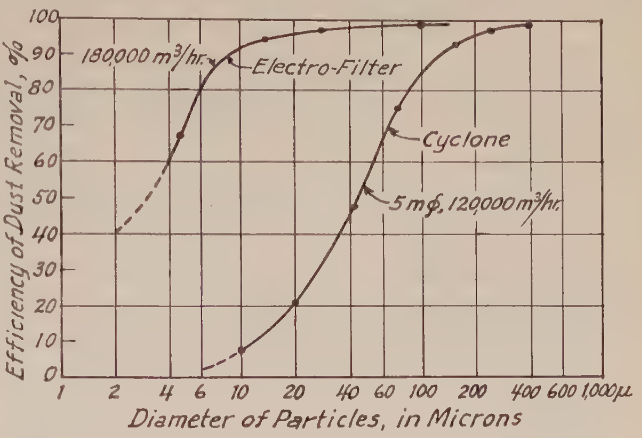


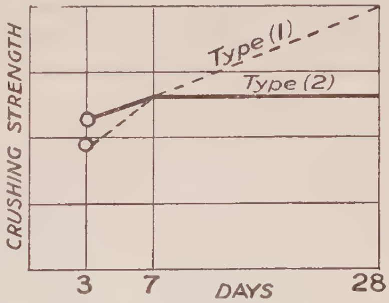
Figure 7. Separation of dust particles of various sizes in the electro-filter and in the cyclone, showing efficiency of dust removal

Use of Rankin Diagram in Burning Cement

An article by S. Solacoglu, originally published in *Zement* (Berlin) and translated in the December (1934) number of *Cement and Cement Manufacture* (London), describes the burning and testing of a series of synthetic cements. The cements were burned in an electric furnace or, where necessary, in the oxy-acetylene flame. The resulting cements are ground and tested by Kuhl's miniature testing process* and the results are compared by means of the "relative strength values."* The mixtures for burning were arranged so that the silica modulus varied in nine steps from 2.0 to 0.0. The ratio $Fe_2O_3/(SiO_2 + Al_2O_3)$ was maintained constant throughout, viz., 5/25. For each silica modulus a number of burns were made with mixes of varying lime content between lime saturation factor (L.S.F.) 100 and 20. The Rankin diagram was used to plot the mixtures investigated. The results for the nine silica moduli are plotted as curves for L.S.F. against relative strength value.

This indicates the existence of two types of aluminous cement, viz., type (1) (the ordinary fused cement) with higher lime content, and type (2) (not hitherto described) with lower lime content. Type (1) has high initial strength, but the subsequent increase in strength is small. Type (2) also has high initial strength, but somewhat lower than type (1); in this case, however, there is an important increase in strength with time. The crushing strength history of the two types is shown in the diagram.

Crushing strength of synthetic cements



Type (1) has a minimum melting point (1,335 deg. C.), that of type (2) (1,415 deg.) being higher. The following are percentage analyses of the two types:—Type (1): SiO_2 4.89, Al_2O_3 43.68, Fe_2O_3 9.78, CaO 41.65. Silica mod. 0.09, alumina mod. 4.5, L.S.F. 45. Type (2): SiO_2 5.65, Al_2O_3 50.80, Fe_2O_3 11.29, CaO 32.26. Silica mod. 0.09, alumina mod. 4.5, L.S.F. 30.

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*See "Cement Chemistry in Theory and Practice," by Hans Kuhl. Published by Concrete Publications, Ltd. For sale in the United States by the Book Department of CONCRETE.

EDITORIAL

Bulk-Cement Railway Cars Needed

An article in this issue describes and illustrates the recent conversion of thirty box cars of the Delaware & Hudson Railroad into carriers of bulk cement. The alterations required were not expensive, and the work was accomplished in a manner that permits its removal and the return of the cars to regular box-car service, if desired.

Added to the twenty coal cars converted into bulk-cement carriers in 1933, the railroad now has fifty gravity-unloading cars available for this service.

The supply of railway cars equipped for this special purpose is, however, wholly inadequate. The truth of this statement was well demonstrated during the construction of a large addition to the sewage disposal plant at Milwaukee, in the early months of 1934. Because of the large quantity of cement required, it was shipped direct from the cement manufacturing plant at Manitowoc, Wis. The concrete mixing plant at the construction site was equipped to handle cement in bulk, so that this was the logical way to ship it.

Only through the most urgent efforts did the shipper succeed in obtaining the loan of the necessary number of bulk-cement cars from an eastern railroad.

It has been demonstrated beyond question that there is a growing demand for railway cars equipped for the convenient shipment and handling of bulk cement and similar pulverized or granular commodities. It has also been demonstrated beyond question that existing railway cars may be converted to this service at a small cost.

With many railway freight cars standing idle during the last few years, it is curious that railroad officials have been so slow to see the possibilities presented to them. Undoubtedly, the cement industry would utilize bulk-cement railway cars to a much greater extent if more of them were available, and if they could be obtained with a reasonable degree of certainty.

What Type of Dust Collector?

Collection of dust, one of the most troublesome problems in the operation of a cement manufacturing plant, is again brought to the front in the excellent article by Dr. Heinrich, published in a recent number of "Elektrotechnische Zeitschrift" and translated for publication in this issue.

Whether the dust collected in a cement plant is that originating in the crushing or grinding departments, in the kiln gases or in the coal pulverizing department, the cost is likely to be greater than the money value of the product recovered. Dust collected from the clinker-grinding mills and from the packing department is perhaps an exception, for in this case the recovered dust is the finished product, and it is valuable because of its extremely small particle size. However, the primary purpose is that of removing the dust nuisance, both from within the plant and from the surrounding area.

Dr. Heinrich makes out a strong case for electrical precipitation of dust—first, because of the high degree of efficiency of this method; and second, because with the less efficient methods the most finely divided particles—and consequently the most valuable—constitute the portion of the dust that escapes.

Against this latter argument, advocates of various screening and filtering dust collectors point out that their installations are much less expensive than installations for electrical precipitation; and inasmuch as the main purpose is that of removing the dust nuisance, rather than recovering dust because of its value, they accomplish the main purpose even though their efficiency is lower.

This problem, like so many other operating problems, is one that can not be solved by set rules. The best system for one plant may not be the best for another. One plant management may have sound reasons for wanting to recover the highest possible percentage of dust, while in another plant the management may have equally sound reasons for wanting to recover only a large enough proportion to overcome the dust nuisance.

The two cases in question demand wholly different types of collecting systems, though in each case the sytem selected may be the best for that plant.

Public Works in National Planning

Cement manufacturers have ample reason to feel encouraged over the part that cement and concrete will be called upon to play in the construction involved in the federal public works plan submitted to Congress by the President.

An article in the construction section of this issue enumerates the general classes of construction work contemplated under the plan.

Even more encouraging is the growing sentiment favoring the inclusion, as parts of our permanent national policy, of the construction of public works such as slum clearance and other low-cost housing, highway development, elimination of grade crossings, sewage disposal, hydro-electric power development, and so on.

Aside from the present aid to recovery, this trend in our national planning should reduce the destructive fluctuations in construction activity.

What Conditions Produce False-Setting Cements?

Solution Varies and Is Applicable Only to Plant in Which Trouble Occurs — Review of Literature on Five-Year Controversy Over Subject

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ONE of the most discussed problems having to do with cement has been the phenomenon of false-setting, and during the past five years a great deal of space in European trade journals has been taken up with the subject. While a great number of reasons have been advanced for this condition, there has been little or no agreement as to the cause or causes of this phenomenon. There has been a general agreement that false-setting cements have no place or use in concrete construction.

Definition of False-Setting Cements

False-setting cements are not to be confused with quick-setting cements, for the cause and effect of the latter are well known by all cement chemists. Perhaps the best description of false-setting cements is "those cements which, upon mixing with a normal amount of water for the normal time period of mixing, show rapid initial and final setting times when tested with either the Vicat or Gilmore needles, but which, upon being remixed without any further addition of water, may show more or less normal initial and final setting times."

In a staff article[1] appearing in a foreign trade journal flash-setting is described as "the stiffening of a paste of cement and water which occurs a few minutes after mixing, with certain finely ground cements, when the mixing is curtailed to about two minutes."

Stiffening of the paste in some cases is sufficiently pronounced to prevent penetration of the setting-time needles. If mixing is prolonged to four or five minutes the same cement exhibits normal setting properties, entitling it to be classed as a slow-setting cement. On the one hand, opinion is expressed that the false set is in reality a genuine setting time, and that the inevitable disturbance of this setting time during the mixing conditions that pertain to ordinary concrete work might lead to the production of inferior concrete. On the other hand, it is suggested that the false set is nothing more than a stiffening phenomenon due to rapid absorption of water by a very finely ground cement, and that the false set might be entirely ignored.

Tests made show that with 2 minutes mixing time the initial set of a given cement is 8 minutes and the final set 18 minutes. With 5 minutes mixing time the initial set is increased to 40 minutes and the final set to 90 minutes, notwithstanding the fact that only 22.5 per cent of mixing water was used in each test. Further, 1:2:4 compression tests using 6.25 per cent of mixing water, and after rapid gauging and molding of 6-in. cubes, show strengths at 24 hours of 2,550 lb., and at 7 days, 5,800 lb. per sq. in., while the same mixtures subjected to a 20-minute delay between the time of gauging and molding show strengths of 3,100 lb. at 24 hours and 6,300 lb. at 7 days.

A recheck, where 9 per cent of mixing water is used, shows practically the same results and leads to the conclusion that the false set of certain cements can be disregarded and treated as non-existent without any detriment to the early hardening or the ultimate strength of the concrete.

Many Experiments and Studies Made

False-setting cements, also known as "gum" setting cements, came to the attention of Brandenburg[2] in testing a product made by another company. After investigating this phenomenon and being unable to blame the cement proper for this condition, since not only its composition, but combination as microscopically examined appeared to be perfect, he came to the conclusion that something else had happened, and eventually proved experimentally upon his own and other brands of cement that a "gum" set can be induced artificially in any well made cement by raising the finish end mill grinding heats to a temperature of 230 deg. F. and above, where the entirety of the gypsum becomes converted to anhydrite, thus losing its solubility and speed of reaction efficiency as a retarder.

Experiments made in Germany[3] indicate that the false set occasionally observed with finely ground cements is due to the high temperature attained in the grinding mills, which may exceed 110 deg. C. This high temperature combined with attrition causes partial dehydration of the gypsum, which is then no longer able to act as a retarder, and in all probability part of this gypsum is converted to anhydrite which is again hydrated when it comes in contact with water. This explains facts that on prolonged mixing of the so-called fasely setting cement, the setting proceeds normally, and that with only a short period of mixing a normal setting follows an apparently rapid initial set. Therefore, the reason that this abnormal set occurs only in the case of finely ground cements is due to the increased temperature of the mill resulting from the greater work required for grinding, which causes more extensive dehydration of the gypsum.

In India[4] some grinding plants gave considerable trouble with setting time on account of heavy charges of grinding bodies raising the last temperature of the cement to over 170 deg. C., and in two cases where a suction fan and exterior spray cooling was resorted to, the cement became normal setting. In the two cases mentioned the quick setting was probably due to the partial dehydration of the gypsum.

Extensive Literature Available

Bogg[5] disagrees with the explanation that false set is due to the conversion of gypsum to anhydrite owing to high mill temperatures and quotes Meade,[6] who has previously stated that gypsum and anhydrite have practically the same retarding effect on cement.

Bogg further quotes Berger,[7] who is of the opinion that with anhydrite a higher SO_3 content is required than with gypsum to produce the same retarding effect, and further mentions his own experience with two different brands of cements which, after both the initial and final sets had taken place by Vicat needle, and the test pieces removed from the molds, the cements became soft again. On retesting he found that the final set had not gone and the initial set needle penetrated almost completely through the cement test pieces again. In both cases the cement was fresh, and in every other respect the physical and chemical tests showed normality. Bogg concludes that the act of removing the sample from the setting-time mold seems to have disturbed the equilbrium of the set cement, since the first recorded initial and final setting times were normal for the cements in question.

Desch,[8] in advancing his views on the mechanism of the setting and hardening of cement, believes "the cement particles, on hydrolysis, are surrounded by a colloidal layer. In time crystals are formed in this colloid, and hardening is due partly to this crystal formation and partly to the drying out of the colloids which form a glassy mass cementing the particles together. The hydrolysis of cement in water proceeds in stages. Part of the lime is dissolved out as $Ca(OH)_2$, and low-lime silicates and aluminates remain; finally, the cement particles are surrounded by a gelatinous mass of silica and alumina. As the water evaporates the lime solution becomes more concentrated and partially recombines with the acid ingredients to form crystalline compounds."

Opinions Differ

Mehta[9] also disagrees with the explanations that false setting is due to the conversion of gypsum to anhydrite due to high mill temperatures, and states that were this theory true, then cement produced in India would always be of the false set variety, since it is extremely doubtful whether any plant in India can grind cement at a lower temperature than 230 deg. F. without some cooling arrangement on the mill. Mehta cites a case where cement issuing from the mill at temperatures above 300 deg. F. possesses normal set, and he goes on to state that "if the high temperature of the cement in the grinding mills is accompanied with quick set, then the fundamental cause is to be sought in the quality of the clinker, i. e., in the physical conditions effecting the burning in the kiln, since it is just possible that the high temperature may be a contributory cause to the quick set in case of clinker which to all outward appearance seems to be quite well burnt, but which has not been subjected to the right temperature in the clinkering zone or has not been in that zone for a sufficiently long time. While it may be difficult to prove this, it is proved conclusively that high mill temperatures are not the cause of either the false or the quick set." Mehta further discusses tests upon some samples which showed by Vicat needle to have initial sets of 10 to 15 minutes which, when observations were further prolonged after 15 minutes more, the Vicat needle penetrated to the full extent, thus showing that the initial set observed in the first instance was false and that the second set occurred quite normally in from 70 to 100 minutes.

Anzlovar[10] believes the considerable influence of mill temperature on setting time to be attributed to the effect of high temperatures in extracting water from the $CaSO_4.2H_2O$ added to the clinker, thus leading to the phenomenon known as false set, and concludes with the opinion that the $CaSO_4.2H_2O$ is apparently so extensively dehydrated owing to the high mill temperature, combined with the thorough grinding, that on mixing the cement the resulting anhydrite absorbs the mixing water, regenerating the hemihydrate or dihydrate. The water essential to the setting of the cement being thus removed, the result is a false set.

This false set becomes normal when mixing is sufficiently prolonged to enable the anhydrite to form hemi- or dihydrate, thus allowing these compounds to exert their effect on the reaction.

Investigations of World-Wide Scope

Whitworth,[11] after making a number of experiments, concluded that the so-called false set is due to a portion of the gypsum setting separately, the cement itself continuing a normal set, for when gypsum is very finely ground and intimately mixed with cement it builds up a slight internal structure soon after gauging, and the closest analogy that can be given to this structure is that of a sponge soaked with water, the sponge being equivalent to the gypsum structure and the water to the cement. If the dehydrated gypsum is not intimately mixed with the cement, or if the grinding is coarse, the particles of gypsum can not interlock on setting, and can not therefore build up this structure, or the structure is not sufficiently cohesive to hold up the setting-time needle. It appears that there is sufficient SO_3 in solution to retard the setting of the cement proper in cements having this false set. Tensile strength tests on such cements show no difference in strength between a cement gauged quickly and left to harden and a cement re-gauged after the false set had been allowed to develop thoroughly. He found false set in even 1:3 sand mortar, indicating that the sponge structure exists even with this mix.

Koyanagi,[12] after a series of laboratory tests, concluded that an excess of dihydrate or hemihydrate reduces the setting time of cement but does not make it quick setting, while an excess of anhydrite always results in quick setting. By adopting 0.9 to 1.2 per cent SO_3 as the best gypsum addition he experiences no quick setting at normally high mill temperatures, and suggests that the retarding property of gypsum is not destroyed by converting it into anhydrite at temperatures up to 300 deg. C., but adds, that where a quick-setting cement is produced in an over-heated mill, this is due to an excess of anhydrite.

Would Improve Burning of Clinker

Anzlover,[13] in a second article, presents the view that the too rapid solution of the cement particles (hydrolysis) leads to premature initial set, and it is the function of gypsum to retard this hydrolysis, and that it does this by introducing definite concentrations of Ca and SO_4 ions to the mixing water. Since anhydrite is more difficult to dissolve in water than the hydrates of $CaSO_3$, it produces the necessary concentration of the Ca and SO_4 ions too slowly to delay hydrolysis. On the contrary, the rate of hydrolysis of the calcium compounds is increased as a result of the heat set free by the regeneration of gypsum. Thus, the initial set takes place more rapidly than ever and the result is a quick setting cement. The speed of hydrolysis of the lime compounds of the cement is the only factor controlling the setting process. The slower the necessary concentration of Ca and SO_4 ions in the mixing water, the more rapid the hydrolysis. In grinding clinker, therefore, the setting time is regulated by the addition of sulfate of calcium, which is sufficiently rapidly soluble to exert its effect sometime before the hydrolysis of the lime compounds can proceed. Of the three forms of $CaSO_4$, anhydrite is the least suited to this purpose. However, it can scarcely be doubted that anhydrite is formed as a result of the temperature attained in the mill.

Anzlovar, like Mehta, believes that by improving the burning by arranging for the clinker to remain a longer time in the clinkering zone, a clinker is obtained that will not prove quick setting despite high mill temperatures, and he states that full reliance can be placed on this observation, which his own experience confirms. He believes the correct explanation lies in the assumption that the longer and more intensive burning gives rise to lime compounds which are not so readily hydrolyzed as those formed on moderate burning of too short duration. Anzlover does not agree generally with Desch, Whitworth and Koyanagi as to the theories advanced by them, to which Koyanagi[14] replies at some length.

Whitworth,[15] after more tests, finds on heating cement to 150 deg. C. that a false set occurs which on heating to 200 deg. C. is replaced by a quick set, but upon being heated to 500 deg. C. becomes a normal set. It appears from these experiments that anhydrite in the beta (insoluble) form has no retarding influence on the setting of cement. It is also obvious, from the speed of the rapid set, that if the retarder is to be effective it must in all probability be very rapidly soluble. The anhydrite (alpha form) and the hemihydrate both fulfill this condition, and the dihydrate to a lesser degree. Therefore, if the theory of a partial recrystallization of the dehydrated gypsum as the cause of false set is correct, and it certainly appears the most reasonable yet presented, then the calcium sulfate must be equally effective before, during, or after crystallization, or a sufficient quantity must still be in solution to retard the set. In the latter case the quantity would appear to be small. Thus it is suggested that the calcium sulfate acts partially catalytically.

Meeting Problem Face to Face

Thus we have had an opportunity of learning of the various results that have been obtained with false-setting cements at a number of factories situated in distant parts of the world, of the experiments that have been carried out, and of the theories that have been advanced concerning this phenomenon.

While the writer has on a number of occasions come in contact with quick-setting cements where lack of gypsum, incorrect chemical compositions, high finenesses and the like were to blame, it is only in recent years that he has been confronted with the phenomenon of false-setting cement; and, like others, he was for a time stumped as to the cause or causes for their occurrence.

In the starting up of a new unit the clinker, in passing through the cooler, was broken up into fine particles, the majority of which passed the ½-in. sieve. In the older unit the clinker as discharged from the cooler ranged in size from 1½ in. and down.

This finely broken-up clinker, on being passed directly from the cooler to the cement mills, resulted in a finished cement of high quality and no different from that manufactured in the older units, as concerns quality. This same finely divided clinker, in excess of that required for the mills, was deposited on the outside storage as formerly, and upon the filling up of available storage space the kiln was shut down, and clinker for the mills was taken from storage. During the short time the kiln was down, heavy rains occurred daily, with the result that the clinker became very wet. Upon attempting to grind this wet clinker considerable difficulty was encountered in the choking up of not only the preliminary and fine-grinding cement mills, but in the stopping up of conveyors and elevator chutes as well; and to top off matters, the cement was found to be flash-setting.

Until the cause could be discovered for this condition, the first step taken was gradually to increase the addition of gypsum to the clinker, and where the SO_3 content of the cement previously had averaged 1.85 per cent, the SO_3 content was gradually built up to as high as 6.5 per cent without eliminating the flash-setting of the cement. In fact, with the higher SO_3 content the cement seemed to become more workable under the trowel and very plastic, but the setting time of the cement continued to range between a flash set and 1 to 4 minutes, with the final set coming so close on top of the initial that they could be scarcely distinguished.

It was then thought that the high mill temperatures (which ranged up to 380 deg. F. due to light feed) were at fault, and that dehydration of the gypsum was the cause of the flash sets, but with the installation of an exhaust fan that lowered the temperature of the discharge cement considerably, the flash sets continued.

Getting at Source of Trouble

Samples of clinker were then taken from all over the outside storage, dried in the laboratory at 110 deg. C. and ground in a small mill with the equivalent gypsum of 1.8 per cent SO_3 in the cement. All pats showed normal setting times. Chemical analyses of the clinker previously, and on retake samples showed it to be of normal composition, while appearance showed the clinker to be well burnt and normal in all respects with the exception of the moisture content, which was found to be around 5 per cent. However, while the setting time of the dried clinker was normal, that of the cement from the mills continued to be flash set.

The next step was to drop the cement fineness from a normal 92.5 per cent passing the No. 200 mesh, to as low as 80 per cent, flash set continued. In making up the pats in the laboratory, as much as 10 per cent over the usual amount of water was used without any change from the flash set, and instead of mixing the paste only the.

usual 1 minute, mixing was continued as long as 3 minutes with the same result—flash set. During these tests it was discovered that upon taking the set pat from the glass and remixing without any further addition of water, workability of the paste improved; and upon again being moulded into a pat, more or less normal initial setting times were obtained, though the final sets were considerably longer than normal. Continued tests made with previously flash-setting pats, remixed without any further addition of water, also showed this phenomenon. Similarly, 1:3 sand mixtures set up quickly, but upon being remixed became workable and the mortar could be placed in the molds satisfactorily. However, tensile strengths were found to have suffered greatly.

Samples of cement taken at 15-minute intervals from the mills would, on occasion, show normal setting times, and thorough investigation of this cement would, in each case, show it to have a lower moisture content than the cement from which flash sets were obtained.

Wet and Dry Clinker

Further investigation showed that the crane bucket at times dipped into the bottom of the clinker storage and brought forth comparatively dry clinker, and in following this dry clinker through the mills it was found that whenever batches of dry clinker were being ground, setting of the cement would become normal, only to be followed by flash sets when wet clinker again found its way into the mill system. To confirm these findings absolutely, the crane operator was instructed to throw aside all wet clinker and deliver only the dry clinker to the mills. As was hoped, yet expected, with only dry clinker going to the mills the flash sets disappeared, and normal sets were obtained. Upon starting up the kiln and sending fresh clinker direct to the mills, normal sets continued; but when too much wet clinker was mixed in, flash setting reoccurred. The situation was entirely remedied by mixing off as little as possible of the wet clinker with the dry, and the phenomenon of false-setting cement was cleared up to our entire satisfaction.

Samples of the flash, or false-setting cement, were set aside for thorough laboratory and concrete field tests. Of the concrete slabs, blocks, etc., made up with these cements in mixtures ranging from 1:2 sand to 1:3:6 concrete, more or less uniform results were obtained in each test—the specimens setting up after preliminary mixing, but upon being re-mixed, hardened very slowly. When after a number of days the specimens had sufficiently hardened to permit removal from forms, little or no strength was shown. These specimens, re-tested at ages up to three months, still had little strength and could be kicked apart. Laboratory tests, however, gave somewhat better results, and at the age of 28 days 1:3 sand briquettes had, roughly, 50 per cent of the strength of normal cement.

Summary of Facts Discovered

The writer's experience in connection with false-set portland cement can therefore be summed up as follows:—(a) Grinding of too wet clinker was the cause of the false-set phenomenon; (b) high mill temperatures were not a contributing factor; (c) increased amounts of gypsum did not relieve the false-setting condition. In fact, too great additions seemed not only to aggravate the situation, but to cause other complications as well; (d) wet clinker, normally false-setting, will have normal setting properties if first dried before being ground; (e) chemical composition was not a contributing factor to false set; (f) fineness of grinding had no influence upon set; (g) flash-setting cement, remixed without further addition of water, gave more or less normal sets; (h) mortar and concrete field test pieces made up with false-setting cement developed little or no strength, while laboratory tests showed strengths as high as 50 per cent of normal at 28 days; (i) there was no noticeable heat generation, contraction or expansion in the false-setting cements.

The results of these findings would suggest that there is no cut-and-dried explanation as to what composes the phenomenon of false-setting cements. It would appear that each plant is a problem in itself and that there is no one theory that will cover the question.

In the development of the new processed Atoyac cement it was thought that considerable difficulties would be experienced with respect to the setting time of the new cement, in view of the fact that grinding is carried out under conditions of control that include a fairly high moisture content, and grinding is carried out at high mill temperatures to fairly high finenesses. It has been found, however, in the case of the new cement, that these factors contribute to the high quality of the product, instead of having a disastrous effect.

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[9] Mehta, Cement & Cement Manufacture, February, 1930.
[10] Anzlovar, Zement, 1930.
[11] Whitworth, Cement & Cement Manufacture, April, 1930.
[12] Koyanagi, Zement, Volume 19, 1930.
[13] Anzlovar, Cement & Cement Manufacture, April, 1931.
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[15] Whitworth, Cement & Cement Manufacture, September, 1931.

Bulk Cement Carriers

(*Continued from page* 36)

ing unloading operations. Specifically, the hopper bottoms are at an agle of 50 deg. with the horizontal.

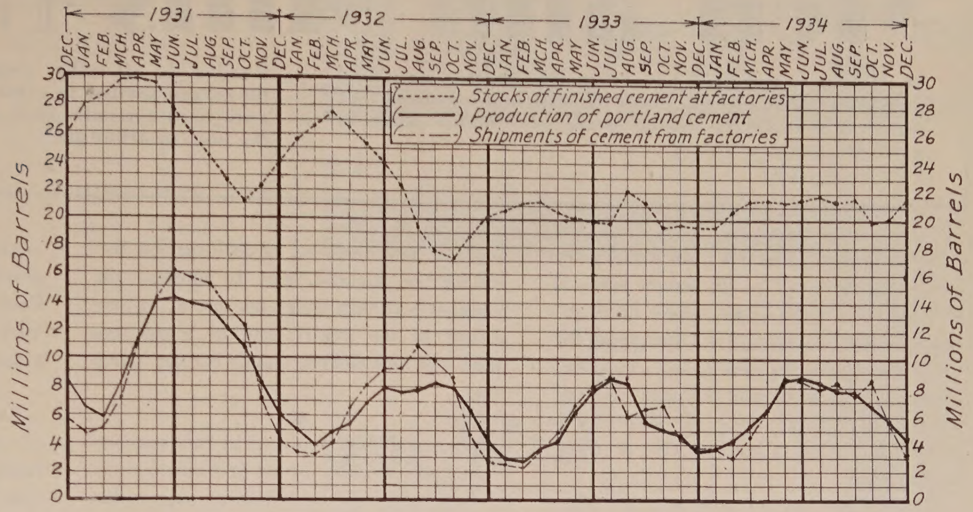
Receiving Facilities Are Simple

Only simple facilities are required for the receipt of bulk cement in railway cars of these types. A protected screw conveyor is installed under the track rails, in a space excavated between two ties. This screw conveyor receives the cement and moves it horizontally to the boot of an elevator or the receiving hopper of a cement pump, from which the cement is conveyed to its destination.

There is little question that the cement industry would make greater use of bulk-cement railway cars if a greater number of them were available, and if they could be obtained without difficulty.

Cement Statistics for December

PRODUCTION of portland cement in December, 1934, showed an increase of 26.1 per cent and shipments a decrease of 17.0 per cent, as compared with December, 1933. Portland cement stocks at mills were 9.6 per cent higher than a year ago.



Relation of Production to Capacity (Per Cent)

	The Month	Twelve Months
December, 1934	19.5	29.0
December, 1933	15.5	23.6
November, 1934	26.2	28.7
October, 1934	29.3	28.3
September, 1934	34.8	27.6

Production, Shipments and Stocks of Finished Portland Cement (Barrels)

	1933	1934
Production, December	3,526,000	4,447,000
Shipments, December	3,738,000	3,104,000
Stocks at end of month	19,541,000	21,421,000
Production for year to date	63,373,000	77,682,000
Shipments for year to date	64,086,000	75,917,000

Production and Shipments of Portland Cement

SHIPMENTS of portland cement totaled 75,917,000 bbl. in 1934, compared with 64,086,000 bbl. in 1933. Production in 1934 was 77,682,000 bbl., compared with 63,373,000 bbl. in 1933. The table provides a month-by-month comparison of both production and shipments during the two years. In the table the last three figures (000) are omitted.

Production and Shipments of Portland Cement, in Thousands of Barrels

	Production		Shipments	
Month	1933	1934	1933	1934
January	2,958	3,779	2,502	3,778
February	2,777	4,168	2,278	2,952
March	3,684	5,257	3,510	4,618
April	4,183	6,544	4,949	6,492
May	6,262	8,554	6,709	8,784
June	7,804	8,813	7,979	8,541
July	8,609	8,144	8,697	7,898
August	8,223	7,842	5,994	8,249
September	5,638	7,680	6,517	7,388
October	5,037	6,675	6,750	8,439
November	4,672	5,779	4,463	5,674
December	3,526	4,447	3,738	3,104
	63,373	77,682	64,086	75,917

Allis-Chalmers Entertains 30,000 Visitors

DISPLAYING a line of equipment claimed to be more diversified than that of any other company in the world, the Allis-Chalmers Manufacturing Co., on Saturday, January 19, was host at "open house" to a crowd estimated at more than 30,000 visitors. Chief attractions were the huge hydraulic turbines for Boulder Dam, but there were other products numbering into the hundreds, and placed on display by the eight major departments of the company.

From the smallest Texrope drive weighing a fraction of a pound to the huge steam turbine for Port Washington, Wisconsin, weighing 860 tons; from farm tillage tools to flour milling machinery, Allis-Chalmers displayed its line, which plays a part in the industrial workings of almost every industry.

Other large units of equipment on display included cranes for handling heavy loads; castings up to 120 tons in weight; crushers handling rocks weighing 25 tons, and crushing at the rate of 1,000 tons an hour; gas engines up to 10,000 hp. each; and steam engines up to 18,000 hp. each.

OBITUARY

N. A. Kelly, sales manager, New York, Universal Atlas Cement Company, died at his home in Forest Hills, L. I., on January 16.

During his early years he was associated with two prominent contracting companies—Lee and Casey, general contractors, Pittsburgh, and T. A. Gillespie Co., general contractors, Pittsburgh and New York. With this background in construction work, Mr. Kelly, on October 6, 1911, joined the Universal Atlas organization as salesman at Pittsburgh, and spent nearly half his life with that company. On December 13, 1915 he was appointed division sales manager at Pittsburgh, and on January 1, 1919, he was transferred to New York, where he served in the same capacity. On November 15, 1928, he became sales manager.

Men and Mills

News of and for Cement Mill Men

A clearing-house page for all kinds of local cement mill news—to promote the comradeship and mutuality of interest that exists among those who make portland cement.

Readers in all mills, even though not regular contributors, are invited to send in news notes about personal and plant activities that may be of interest or value to the men in other mills.

R. R. Coghlan, who has been with Dewey and Almy Chemical Co. for several years, is now on the Pacific Coast, where he is engaged in the installation of equipment for the production of the special "poly-purpose" cement developed by this company. He can be reached through the head office of the Dewey and Almy Chemical Co., at Cambridge, Mass.

Mr. Coghlan was formerly with the Marquette Cement Manufacturing Co., in the capacity of chemical engineer, where he devoted much of his time to the installation and adjustment of equipment for the manufacture of super-cement. Prior to his Marquette connection he served as chemical engineer for the Southwestern Portland Cement Co.

Mr. Coghlan has been a generous contributor to the literature of cement manufacture, through the pages of the *Cement Mill Edition* of CONCRETE. Perhaps his most notable work of this character was the series of articles on "Power Plant and Kiln Design and Operation," written in collaboration with T. H. Arnold and published in successive issues of the *Cement Mill Edition* of CONCRETE from October, 1926, to May, 1927. His most recent contribution, on "Utilization of Heat from Clinker for Preheating Secondary Air," appeared in the issue of May, 1933.

●

The Buffington plant of the *Universal Atlas Cement Company* completed the year 1934 with a safety record unmarred by a disabling injury to any of its people, according to an announcement by Gordon C. Huth, manager of the company's Safety Bureau. By this accomplishment, the Buffington plant became eligible for the Portland Cement Association trophy awarded annually to plants which possess an accident-free record for the calendar year. In addition, the company's Duluth plant became a six-time winner of the trophy, and its Pittsburgh plant was awarded the trophy for the fourth time.

●

Reports already rendered by *International Cement Corporation* for the first nine months of 1934 show vast improvement over recent preceding periods as to earnings, and suggest that the company may show for the full year a profit in excess of $1 a share. This would be the first profit reported by the company since 1931.

Signaling the extent of recovery a dividend of 25 cents a share was paid December 31, 1934, to holders of record December 11, the first such distribution since the quarterly payment of 50 cents a share was made March 31, 1932.

●

Appointment of *W. E. Barker* as southeastern regional highway engineer with offices in Atlanta, was announced as field engineers of the Portland Cement Association entered upon the final day of their convention in Atlanta on January 9.

Mr. Barker has been located in Chicago at the general office of the association. In his new capacity he will aid field men in the nine southeastern states to promote construction of roads designed to carry their traffic load.

●

The Mason City, Iowa, plant of the *Lehigh Portland Cement Company* shut down operations Saturday, December 15. Part of the force of employes was retained to carry on the regular repair work, usually done at the annual shutdown periods.

The repair work this season includes the installation of air separators in the clinker grinding department, according to W. H. Patterson, superintendent. Other repair work will be done throughout the plant in preparation for reopening.

●

Canada Cement Co., Ltd. (*Canada*), for the year ended November 30, reports net income after depreciation, expenses and other charges of $55,165, equal to 27 cents a share on 200,869 6½ per cent preference shares, against $76,914, or 38 cents a preference share, in the previous year.

●

Earnings of the *Pennsylvania-Dixie Cement Corporation* increased approximately $1,000,000 last year over the figure for the preceding twelve months, it was learned on competent authority in advance of the company's annual statement.—*Chattanooga* (*Tenn.*) *Times*, Jan. 5, 1935.

●

The Hannibal, Mo., plant of the *Universal Atlas Cement Company* will resume operations February 1, a month ahead of the scheduled date. Between 350 and 400 men will be reemployed.

The plant has been closed since November 1.

●

Reflecting general business improvement throughout its territory, the *Ideal Cement Company's* shipments so far this year are 37.4 per cent higher than in the corresponding period of 1933, it was announced recently.

●

Alpha Portland Cement Co. declared a dividend of 25 cents on the common, payable January 25 to stock of record January 2. The last previous payment on the common stock was 25 cents a share on April 25, 1932.

Mill Supplies

NITRAMON is a new blasting material for use in quarries and in other blasting operations such as stripping—announced at the eighteenth annual Technical Section convention of the Explosives Department of the du Pont Company, which opened January 22, at Wilmington, Delaware. This new product, it was stated, cannot be detonated by the strongest commercial blasting cap, by impact, by flame, nor by shooting a rifle bullet into it. In actual use it is exploded by means of a large diameter cartridge of dynamite. It is non-headache producing and is rendered absolutely water resistant by being sealed up tightly in a tin can. It is said to represent the ultimate in safety in so far as a blasting agent is concerned. It represent a very radical departure in the explosives field. This new development has been covered by two patents, one for the product itself and the other covering its method of use. It is non-freezing.

The new product will be marketed only in large diameters, for example, four, four and one half, five and seven inches. It is adapted solely for use in large diameters and has been designed specifically to fulfil as nearly as possible the ideal qualifications for use in quarries and in coal stripping operations.

Work on this new explosive has been going on for months. It has been tested in the laboratory, in the field and by agencies outside the company, they say.